

Replaces California Institute of Technology  
Social Sciences Working Paper #213

**MIT Press Series on the Regulation of Economic Activity**

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**Studies in Public Regulation**

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The MIT Press  
Cambridge, Massachusetts  
London, England

## Regulation in Theory and Practice: An Overview

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During the past twenty-five years the amount of research on the economics of government regulation has increased enormously. The study of public-policy approaches to problems in industrial organization was once limited almost exclusively to antitrust policy and the regulation of a few industries with natural monopoly characteristics. This area of inquiry has been transformed as new administrative agencies with powers to set prices, restrict entry, and control what products are produced, and how, have come to affect the efficiency of industrial markets and the distribution of production and income throughout the economy.

The increased attention to the economics of administrative regulation is due to a number of factors. First, research has benefited considerably since the late 1950s from the application of modern statistical analysis and the mathematics of constrained optimization. Although technically unsophisticated by contemporary standards, the classic works by Averch and Johnson (1962), Caves (1962), Meyer et al. (1959), and Stigler and Friedland (1962) represent a watershed in the study of economic regulation by administrative agencies. What economists now know about the effects of government regulation on economic activity that they did not know twenty years ago is, for the most part, attributable to the kinds of analytical techniques that were first used in a handful of classic papers such as these.

A second reason for the expansion of scholarly interest in this area is the increasing importance of administrative regulation in the U.S. economy. Regulation spread to more and more sectors of the economy, and the relative importance of such heavily regulated sectors as transportation, energy, and telecommunications has also increased. The impact of environmental, safety, and health regulations cuts across the entire economy. It is now almost impossible to study any important industrial market in the U.S. economy without taking account of the effects of the many restrictions on the behavior of economic agents that have been established and are administered by one or more regulatory agencies.

Third, economists have had to come to grips with important contradictions between theoretical prescriptions to remedy market imperfec-

tions so as to increase economic welfare and the actual behavior and performance of regulatory agencies. Implementation of theoretical schemes designed to ameliorate market imperfections has often proved to be difficult and costly, and the regulatory process has often created its own imperfections. In addition, what regulatory agencies attempt to do and how they go about it are influenced by political and bureaucratic processes which economists rarely, if ever, considered in suggesting regulatory policies to deal with market imperfections.

We have been asked to begin this compendium by presenting an overview of the large and rapidly expanding scholarly literature on regulation. An initial reluctance to engage in such an endeavor has been replaced by the conviction that a critical overview of this literature is especially appropriate at this time. No comprehensive review of the recent literature exists in any easily available form. For anyone interested in the field—especially students—this makes life fairly difficult. More important is the possibility that research on the economics of regulation may well be at a crossroads. In particular, applying the traditional theoretical and empirical tools to study the traditional regulated industries has reached the point of rapidly diminishing returns. In some cases strong qualitative results have emerged. Additional research can refine the quantitative significance of these results, but it is not likely to change any basic conclusions about the effects or desirability of government regulation. In other areas, the traditional tools have not yielded strong quantitative results, and there is little hope that they will. In these areas new conceptual tools and empirical techniques appear necessary if significant progress is to be made. Research on regulation may be at a crossroads on an even more basic level, in that changes are taking place in the perspective from which scholars ask questions about regulation. Most of the empirical literature on regulation is motivated by some variant of the question of regulation versus deregulation: Is regulation socially desirable? A negative response implies reliance on a real or imaginary free market. In our opinion, very few situations in which there is a clear “yes” or “no” answer to this question have not already been well worked over, and even these are sufficiently similar to those that have been exhaustively studied that the results of the studies can be easily generalized to them.

Many areas of research in which there are few clear theoretical or empirical results also cannot effectively be attacked by comparing regulation with the absence of regulation, because a completely unregulated market is not a viable, practical alternative. The issues in these areas

often involve problems of evaluating different regulatory instruments, regulatory processes, and extents of regulation, and determining the distribution of costs and benefits throughout the population that results from a particular set of regulatory activities. Indeed, even in cases in which there is a clear case for deregulation, distribution must be explored to make the case in the political arena as well as to structure a politically acceptable transition from a regulated to an unregulated state.

We shall develop these arguments further in this article. The bulk of the discussion is devoted to the original assignment: a summary and a critical evaluation of the more important areas of contemporary research on the economics of regulation. We supplement this discussion with some suggestions and speculations about promising directions for future research in regulatory economics. No attempt is made to cover everything that might reasonably be included under the heading of regulatory economics. Our focus is on regulatory activities conducted by administrative agencies, either independent or within the executive branch of government, that have been delegated regulatory responsibility by statute. We exclude antitrust policy and regulatory activities administered directly by the courts (such as property law, liability law, and contract law). These policy instruments are alternatives to administrative regulation, for they define the basic institutional context in which a market, free from administrative regulation, operates. It is in this context that we believe these instruments should be evaluated, and the task of doing so is well beyond the scope of this paper.

### **Government Regulation of Industry: An Overview**

Studies of regulation, whether theoretical or empirical, normally fall into three areas: price and entry regulation in industries with competitive market structures, price and entry regulation in monopolistic industries, and (for want of a better term) “qualitative” regulation, which attempts to cope with various kinds of market-failure problems that are only indirectly linked to prices, profits, and market structure. In the third category are environmental, health, occupational-safety, and product-quality regulation. We shall examine the research results in each of these areas separately. In addition, no overview of this field would be complete without considering theories of regulation that seek to answer very general questions about the behavior of regulatory agencies as a class of government institutions. This section concludes with a review of various theories of regulation.

### Price Regulation in Industries with Competitive Market Structures

If economics has any scientifically settled issues, one is surely that price and entry regulation in perfectly competitive industries generates economic inefficiencies. As a theoretical matter, the result is trivial: Under standard neoclassical assumptions about human motivation, frictionless markets, and production technologies, an externally imposed constraint upon the actors in an otherwise perfectly competitive market can do no better than leave the market as efficient as it was before the constraint was imposed. And, because implementing the constraint must consume some resources, society must always operate more efficiently if a competitive market is simply left alone.

The contribution of the literature on regulating competition is that the data confirm the theory in several key economic sectors that nearly all nations attempt to regulate. Economic research has demonstrated convincingly that price and entry regulation in agriculture (an industry we shall henceforth ignore, because of our ignorance about the research on it), transportation, and oil and natural-gas production creates economic inefficiencies. Usually this inefficiency is manifested in higher prices, higher production costs, and slower technological progress than would occur without regulation. In a few instances, such as regulation of hydrocarbon fuels, the inefficiency is created by prices that are too low to clear markets, which leads to inefficient patterns of commodity utilization.

In the 1960s, the standard approach to estimating the inefficiencies of regulating competition was to compare equilibrium prices, costs, and quantities in regulated and unregulated situations. These comparisons could be based upon direct observation when unregulated and regulated markets operated simultaneously, or when relatively recent changes in the nature of regulation permitted easy intertemporal comparisons. Examples of research of this type include the analysis by Snitzler and Byrne (1958, 1959) of the agricultural exemption in trucking, the study by Joskow (1973b) of state regulation of property and liability insurance, the research by Stigler (1971) on occupational licensing, MacAvoy's (1973) and Pindyck's (1974) studies of the effects of imposing natural-gas field-price regulation, the comparisons of interstate and California intrastate airline service by Levine (1965), Jordan (1970), and Keeler (1972), and the study of gas pipelines by MacAvoy and Noll (1973). Montgomery's 1978 examination of FEA controls of petroleum applied the same approach to a more recent regulatory development. Each of these studies found that efficiency losses due to regulation were large in

proportion to total transactions in regulated markets. Owing to their base in relatively recent empirical information, these studies have to be taken seriously in current debates about public policy. For example, the Interstate Commerce Commission (1976) felt called upon to attempt a formal rebuttal of a study by Moore (1975) that was based upon the same methods and some of the same data as the Snitzler and Byrne papers.

One difficulty with the comparative approach to studying the effects of regulation is that, in some instances, regulation has been in force for so long that studies of the effects of the imposition of regulation or of unregulated markets have questionable current quantitative value. MacAvoy (1956) and Spann and Erickson (1970) examined the effects of the early actions of the ICC on railroad prices and identified efficiency losses of the same sort that more recent studies have found in airlines, trucking, and hydrocarbon fuels. However, such studies have less immediacy in current policy debates, because of the impossibility of directly extrapolating findings from the 1880s into the present. Ideally, we would like to have matched samples of contemporary regulated and unregulated firms to enable us to make clear comparisons between regulated and unregulated industry behavior and performance. Unfortunately, we rarely have this opportunity. Often, lacking data on unregulated firms, we must infer what the unregulated industry would look like.

Several studies, beginning with Meyer et al. (1959), have attempted to infer the inefficiencies of existing ICC regulation solely from data dealing with regulated operations, without the benefit of comparisons between regulated and unregulated states of the world. One feature of regulated competition has been that regulators have tended to set prices on the basis of uniform formulas for particular categories of service that apply across several firms and markets. Because regulators apparently are loath to take actions to weed out inefficient operations, these prices are usually set high enough so that considerable variability in the cost of providing service can be observed among economically viable firms and technologies. Thus, one approach to estimating the cost of regulation is to measure the cost penalty associated with the protective price umbrella that regulators constructs for the inefficient. For example, Meyer et al. (1959), Friedlaender (1969), and Harbeson (1969) argued that one cost of ICC regulation is a misallocation of freight transport among competing modes. They estimated its magnitude by comparing the cost of shipping different categories of commodities various distances by competing modes. A conceptually similar approach was taken by MacAvoy and

Sloss (1967) and Gellman (1971) in arguing that ICC price-setting policies and formulas had prevented or retarded warranted cost-reducing innovations such as the unit train, the "Big John" hopper car, and truck-rail piggybacking.

Until about 1970, the studies that have been discussed so far were generally regarded as providing relatively good quantitative estimates of the costs of regulating a variety of markets with competitive market structures. But all of these studies share the assumption that the nature of a regulated industry's product is homogeneous. Although variable product quality was mentioned in several earlier studies (notably, Caves 1962 and Eads 1972), Douglas and Miller (1974) (for airlines) and Boyer (1977) and Levin (1978) (for surface transportation) demonstrated that this assumption could lead to overestimation of the cost of price regulation. A key observation is that regulatory agencies are more effective in controlling prices than in establishing the quality of service offered by a regulated firm. As a result, in multifirm regulated markets the firms compete by varying the quality of service. In the airline industry this takes the form of competition in flight frequency, choice of aircraft, and (where not controlled directly) service amenities such as meals, seat width, and lounge facilities. Competition in dimensions other than price leads to excessive service quality, and therefore to higher average costs and prices, while continually driving earned rates of return to competitive levels.

The analytical treatment by Douglas and Miller (1974), Eads (1975), and DeVany (1974) of competitive rivalry where minimum prices are fixed has widespread potential application. The general point is that prices, costs, and price-cost margins in a regulated multifirm market cannot give a correct measure of the inefficiency caused by regulation because service quality is lower in unregulated markets. One must evaluate the price-quality combination and compare it with the optimum in order to estimate the cost of regulation. This general insight is applicable to other examples of multifirm regulation, such as trucks, taxis, insurance, banking, and occupational licensing. Ideally, with observations on regulated and unregulated firms, cost could be estimated relatively easily by comparing price, cost, and quality outcomes in the two markets. An example is the common comparison of interstate airline markets regulated by the Civil Aeronautics Board with similar unregulated routes in California and Texas. Unfortunately, in many industries such comparisons cannot be made, and the regulated price, cost, and quality equilibrium must be inferred from simulations of competitive equilibrium.

Boyer (1977) and Levin (1978) recognized the importance of product quality in measuring the costs associated with the misallocation of freight among competing transport modes due to price regulation. Both argued that the relative-cost approach of Meyer et al. (1959) and subsequent studies leads to serious overestimation of the amount of traffic that is not now shipped by the least costly mode. The relative-cost method overlooks important differences in the attributes of service quality among modes. Boyer and Levin concluded that intermodal substitution possibilities are far more limited than the previous studies had implicitly assumed, and cited as evidence the small price elasticities of demand that they estimated from econometric models of the freight-transport sector. Their studies led to estimates of the cost of intermodal misallocation of freight resulting from price regulation that are an order of magnitude lower than estimates based on relative-cost studies.

Unlike the studies of the airline industry that deal with service quality, Boyer's and Levin's retained the assumption that service quality is exogenous to regulation. A next step in this line of research is to attempt to determine whether regulation affects the relative service qualities of freight-transportation modes, and, in particular, whether the structure of regulation has caused part of the spread in service quality among competing modes. If so, the true cost of price regulation would lie somewhere between the estimates derived from the relative-cost approach, which implicitly assumes that the modes are perfect substitutes, and the calculations provided by Boyer and by Levin.

Relaxing the implicit assumption that product quality is invariant with respect to changes in regulation creates difficult theoretical and empirical problems. The likelihood that quality of service has more dimensions in surface freight transport than in passenger air transport makes the required theoretical and empirical analysis more difficult. The problem is greater still in other sectors, for in transportation the most important facets of service quality have to do with speed, frequency of service, and freight-damage rates, all of which are easier to model and to quantify than are the elements of quality that are important in other sectors of the economy. Endogenizing quality may be important in numerous competitive regulated markets in which the dimensions of quality are more ephemeral and the task of the research scholar in estimating the effects of regulation is therefore exceptionally difficult.

Nevertheless, new research along these lines is unlikely to change the conclusions of economists about the wisdom of subjecting competitive industries to price and entry regulation. In many cases, variable product

quality is not a potentially important issue. Hydrocarbon fuels, for example, are relatively homogeneous; moreover, regulation attempts (not completely successfully) to account for physical differences in the composition of fuels from different sources. In cases in which quality is potentially important, more sophisticated research will change numerical estimates of the cost of regulation; however, in the absence of a case for regulatory interventions designed to affect quality directly, regulation can only lead to a departure from efficient combinations of price, quality, cost, and output. In an era when economists are often accused of being unable to agree on anything, we find comfort in the virtually unanimous professional conclusion that price and entry regulation in several multifirm markets is inefficient and ought to be eliminated.

In light of the surprising consensus among economists about the appropriate direction for public policy in a number of important industries with competitive market structures, the question remains why efforts to eliminate price and entry controls have met with such stiff resistance. Gradual deregulation of interstate airline rates and entry was accomplished after years of debate. Deregulation of surface freight transportation has faced much stiffer resistance, as have similar efforts in telecommunications. To most regulatory economists, "regulatory reform" means the elimination of regulation in these markets, and the failure of public officials to move quickly in response to these findings is a great disappointment that leads to skepticism about the policy impact of economic research. We believe that there are a number of reasons why the economic analyses of these industries has not helped as much as it might have in advancing the cause of regulatory reform. But we also believe that the concerns about the impotence of economic analysis in affecting regulatory reform reflect a misperception of the application of scholarly research to the implementation of public policy.

Two basic problems invariably arise in the political debate over major changes in regulatory policy. First, with any major change in government regulation that has important impacts on price, market structure, cost, and product quality, some groups will gain while others lose. On balance, economics research provides a strong case that the financial benefits to those who gain will exceed the cost to those who lose. But, lacking some type of compensation scheme, those who expect to lose are likely to resist a change in policy. If the gainers are widely dispersed and the losers are well organized, the stage is set for the losers to mount an effective political campaign against reform. When it is unclear who is to gain and who is to lose, and how much money is involved, it may become even

easier for the losers to magnify the extent of the potential losses and their distribution. The uncertainty associated with the distribution of gains and losses is compounded by the inherent uncertainty associated with deriving the outcome of deregulation from inference rather than comparison. Unfortunately, economists have devoted little if any consideration to the distribution of costs and benefits associated with existing regulations and proposed regulatory reform. Research on the distributional consequences of deregulation would facilitate the development of workable compensation schemes that would allow an effective political consensus to emerge. Such research would also undermine the ability of the losers to convince others (or their representatives) that they will lose too.

The second problem concerns the transition between regulated and unregulated states of the world. Most economic analysis compares long-run equilibria. But legislators, who are naturally cautious about making major policy changes in key sectors of the economy, are going to look carefully at the short-run response to the elimination of regulatory controls. The greater the inefficiency associated with prevailing regulatory instruments, the greater the likelihood that severe short-run economic dislocations will arise from their elimination. Such short-run dislocations could easily abort a regulatory reform program before it had a chance to achieve a long-run equilibrium. Again, economists have done little research on the dynamic characteristics of transition from a regulated to an unregulated regime. Such research would alert policymakers to the possibility of important short-run industry behavior and performance, as well as contributing to policies that might make the transition smoother and more politically acceptable.

Although further research on the incidence of regulation and deregulation and the nature of the transition path between a regulated and an unregulated regime would add useful information to the policy debate, it is ridiculous to place the burden of proof for regulatory reform on the shoulders of academic economists. Economists can provide an analytical and empirical framework in which the issues can be discussed sensibly, help to identify potential gainers and losers, and suggest transition schemes to smooth out short-run economic dislocations. And they can, of course, make all this information freely available to the public by publishing it. What academic economists can do beyond this is severely limited.

From this perspective, academic research on regulation in industries with competitive market structures has had an important impact. It has

been used extensively by congressmen and the executive branch in the debates on airline deregulation, trucking deregulation, telecommunications policy, and many other regulatory issues. Though such research has not made and will never make the case on its own, it has made an important contribution to elevating the level of public discourse in numerous policy arenas.

### **Price Regulation of Monopoly**

The economics literature is ambivalent about the desirability of regulating monopolies. Because economic theory is firm in concluding that monopolies create economic inefficiency, social intervention to prevent, undo, or control monopoly is potentially attractive. However, because social interventions generate direct and indirect costs through the peculiar kinds of inefficiencies they cause, attempting to deal with monopoly may be at least as costly as leaving it alone. One of the more embarrassing features of the literature on economic regulation is that, after a century of trying, the profession is still unable to reach a consensus on what, to an outsider, must appear to be one of the best-defined and most central issues on which economists ought to have something to say. Where progress has been made, it has generally been in response to an examination of the effects of alternative regulatory mechanisms and in the development of schemes to make price regulation more effective.

Whereas the study of regulated competition has produced essentially one interesting theoretical development—the models of quality competition when prices are set above the competitive level—several interesting microtheoretic developments have come from the study of the regulated monopoly firm. We shall examine three of these.

**The A-J Model** The so-called A-J literature began with the seminal work of Averch and Johnson (1962) and, in our opinion, culminated in a series of papers by Klevorick (1971, 1973). The A-J models examine a monopoly firm that produces output via a neoclassical production technology using two resources: capital and labor. The firm is assumed to seek to maximize some objective, usually profits. A regulatory commission comes into the picture by imposing a constraint on the firm's behavior. It is normally assumed that the firm is constrained to earn on its capital stock some "fair" rate of return that is greater than the cost of capital but less than the unconstrained, profit-maximizing rate of return. Implicitly, the objective of the regulatory commission is assumed to be to keep earned rates of return no higher than the allowed rate of

return. The primary result of the basic model is that such a constrained firm will produce output at greater than minimum cost. In particular, the expansion path of the constrained firm traces a locus of capital-labor ratios that is higher than a cost-minimizing producer would use.

Extensions of the basic A-J model have included the examination of different firm objective functions and different types of regulatory constraints (Bailey and Malone 1970). Not surprisingly, changing the nature of the objective and the constraints alters the basic conclusion. Because a firm can never do better than minimize cost, changing the model either changes the size or the direction of the production inefficiency or returns the firm to the cost-minimizing expansion path. As a result, most work continues to be based on the assumptions of profit maximization and a binding rate-of-return constraint.

Some richness has been added to this model by consideration of the intermittency of regulatory review. A number of attempts to introduce "regulatory lag" into the model have been made. These models normally assign an active (deterministic or probabilistic) role to the regulatory agency. During the "lag" period, the firm is allowed some relaxation of the regulatory constraint (depending on the particular model) but the regulatory commission is always ready to pounce on the firm to force its earned rate of return back to the allowed rate. Such pouncing may occur at set intervals or probabilistically according to some probability distribution known to the firm (Bailey and Malone 1970; Bailey and Coleman 1971; Klevorick 1973).

The welfare implications of rate of return regulation are examined in papers that seek to determine the optimal fair rate of return (Klevorick 1971; Sheshinski 1971). In these models, the optimal rate of return is derived by replacing the maximization of profit by some social-welfare objective. The idea is then to pick the allowed rate of return that yields a constrained welfare maximum. Klevorick (1971), Bailey (1973), and Sheshinski (1971) indicated that some regulation of natural monopoly will always be optimal. This strain of the literature is important because it recognizes that cost minimization cannot be the only criterion for judging a regulatory system. If it were, society would be satisfied with no regulation, because a neoclassical monopoly firm uses its inputs efficiently.

The A-J explanation for the metafact that regulated monopolies appear to be excessively capital-intensive industries has become conventional fare in the economics literature. Whether the predictions of the model are verified by reality is an empirical question that we shall discuss

below; however, eschewing Freidman's methodological advice, we shall offer some opinions on the assumptions and structure of the model, some of which appear in the work of Joskow (1973a, 1974). The A-J results depend on several assumptions that are at variance with the reality of the world of regulated monopoly. Some of these are the standard assumptions of microeconomic models, such as the existence of a continuously differentiable production function, factor and product market prices that are certain, and homogeneous inputs and outputs with exogenously determined characteristics. Other assumptions pertain to the nature of the regulatory process itself, and it is these that we wish to examine more fully.

First, the regulatory agency is assumed to regulate profits only; however, what regulators actually do is regulate prices. The calculation of an allowed profit is a way station along the road to determining how much of an increase in prices will be allowed. Once set, the regulated firm's prices—not its rate of return—are fixed, pending subsequent regulatory review (except for the effects of automatic-adjustment clauses). This fact has important implications for the behavior and performance of regulated firms and regulatory agencies when costs and demand conditions are changing rapidly and there is regulatory lag.

Second, the A-J model ignores the fact that one of the issues in a regulatory proceeding is the determination of allowed costs. Although, admittedly, a regulatory agency is unlikely to be sufficiently expert and to have enough data to exercise very close scrutiny of management decisions in a regulated firm, the agency does review the expenditures and investments of the firm and has the power to identify and disallow costs associated with serious production inefficiencies.

Third, the A-J model implicitly assumes that the planning horizon for capital investments is short in comparison with the interval between regulatory reviews, or at least that the outcome of regulatory reviews is sufficiently predictable over the investment-planning horizon that the firm can select an appropriate investment plan in response to it. In fact, the time spent in constructing a major capital investment is often several times as long as the time between regulatory reviews. A firm's ability to respond quickly to unanticipated changes in the regulatory constraint is, as a result, quite limited. Moreover, the A-J-model literature presumes that the frequency of regulatory reviews is exogenous to the firm. As Joskow (1973a) pointed out, the profits of the firm are an important cause of regulatory review: Low profits and rising nominal costs lead a firm to ask for a price increase, or (less frequently) declining nominal

costs and growing profits cause the regulator or an intervenor to review the performance of a firm in search of a justification for a price reduction. Only when the firm is near the profit rate at which it expects to trigger a regulatory review will it have an incentive to produce inefficiently, for otherwise any increase in profits that is due to a cost reduction will be retained by the firm. Obviously, the fact that actions by the agency and by the firm depend on actions taken by the other introduces the possibility of strategic behavior by both.

In the mid-1970s several empirical tests of the A-J model appeared in the literature. All dealt with the electric utility industry. One (Boyes 1976) found no evidence of the capital-intensity bias, but the result is suspect because the author tested the A-J hypothesis by examining capital-fuel ratios of new generating plants during the electrical conspiracy of the late 1950s. Spann (1974), Courville (1974), and Peterson (1975), using data from other periods, all found inefficiently capital-intensive generation equipment and concluded that the A-J effect had been confirmed. McKay (1976) showed that the conclusions of these studies are unjustified. Peterson's finding that unregulated firms spend relatively less on capital for electricity generation is explained by the fact that most of the unregulated firms in his sample used facilities that burned natural gas, while most of his regulated firms burned other fuels. What Peterson was actually measuring was the lower capital costs of gasburning generators and the consequences of interstate price regulation of gas. Boyes, Courville, and Spann all misspecified the nature of the tradeoff between capital and fuel by using expenditures, rather than energy efficiency, as the measure of capital. McKay found that when the appropriate measure of the efficiency frontier between equipment design and fuel consumption is used, the A-J effect can no longer be detected.

Negative empirical findings do not disprove the A-J hypothesis, for excessively capital-intensive processes could be introduced in many ways other than through the substitution of thermodynamic efficiency for fuel. Nevertheless, in light of the comments already set forth about the extent to which the model incorporates real aspects of the decision problem facing regulated firms, we believe that further empirical work to test the A-J theory (especially studies limited to the electric utility industry) is unlikely to be very productive. In our view, the A-J model is useful primarily in illustrating the implications of one approach to regulating monopolies. The model is interesting not because it represents the way monopolies actually are regulated, but because it calls attention to the value of attempting to represent institutional arrangements in a



formal microtheoretic model for the purpose of determining the incentive structure that such arrangements create. Recent efforts by state utility commissions to monitor utility supply decisions more closely recognize implicitly that rate-of-return regulation may produce incentives that lead a firm to depart from least-cost production in a variety of ways, especially in the current economic environment.

A potentially fruitful line of theoretical inquiry is to formulate models that more faithfully represent the regulatory process. For example, Burness et al. (1980) have formulated a model in which a firm faces a price fixed by the regulator, a requirement to serve all comers, and upper and lower bounds on its rate of return that, when reached, trigger a costly regulatory process that resets prices. This model is intended to capture some of the properties of the regulatory process suggested by Joskow (1974). (See also Hendricks 1975.) Because their model is motivated by questions about the risk-taking propensities of regulated firms, Burness et al. examine only one issue: the attitudes of a regulated firm toward the selection between a negotiated fixed-price contract and a cost-plus contract for constructing new capital facilities. They find that the Joskow model reaches the opposite conclusions as the A-J model: In the A-J world firms pick the fixed-price contract, while in the Joskow world they opt for cost-plus. Burness et al. then examine the history of nuclear steam systems, and find that sales of nuclear power plants increased substantially when the manufacturers switched from a fixed-price system to a cost-plus system, although there are reasons other than the effects of regulation why the switch may have occurred. In any case, this paper is a step along a path that has not been much traveled, and one that holds some hope of shedding substantial light on the efficiency of the production and market decisions of regulated monopolies.

**Sustainability of Natural Monopoly** Beginning with the paper by Faulhaber (1975), economists at New York University and Bell Labs have published a series of interesting papers that deal with a fundamental issue concerning the regulation of natural monopoly: whether optimal (second-best) prices (or, for that matter, any set of prices that cover total costs) can prevent entry into the market of a regulated natural monopoly, even if such entry would increase total production costs and lead to higher prices for some consumers.

Natural monopoly over several commodities can arise from global subadditivity of the cost function—that is, the situation where the cost of producing all commodities together is less than the cost of producing

the same amount of each separately. Contrary to the conventional wisdom, natural monopoly does not guarantee the existence of a vector of break-even prices that will preclude entry (the natural monopoly may not be sustainable for any break-even price vector) even if the natural monopoly is producing output efficiently and charging efficient prices. Very simply, a break-even monopoly may have to set the prices for some services higher than is necessary to recover the “stand-alone” costs of serving some coalition of consumers. If firms enter in response to these price-cost margins, the result will be increases in the total costs of production and in the prices charged for other commodities or to those customers not included in the new coalition.

Panzar and Willig (1977) showed that the presence or the absence of any sustainable (entry-blocking) price vector that covers the natural monopolist’s cost of production depends on interproduct-substitution effects on the demand side, product-specific economies of scale, and economies of joint production. In order for a natural monopoly to be unsustainable, some product-specific economies of scale, or else the economies of joint production, must have been exhausted, so that further increases in the output of some product must raise either its own or some other product’s average cost. If diseconomies of joint production are being experienced at the margin, then greater interproduct-substitution effects and product-specific scale economies will make the existence of sustainable prices less likely. If product-specific diseconomies of scale are present, greater economies of joint production will make the existence of sustainable prices more likely. Baumol et al. (1977) showed that Ramsey-optimal prices will be sustainable under very strong conditions.

To date, the sustainability literature has skirted three major issues that are directly related to its principal theoretical results. First, the models presume perfect regulation that manages to force monopolists to produce at least cost and at zero economic profit. Second, entrants are confined to producing some subset of the products that are being offered by the monopolist, rather than offering other products that are not colocated in goods-characteristic space with the products of the monopolist. Because *ex ante* the monopolist offers all feasible commodities, the question of the optimal product mix is not addressed. Once the product mix is allowed to become variable, the optimal market structure, even with pervasive economies of scale and scope, could be monopolistic competition rather than monopoly. Third, the question of the response of the monopolist to entry—and, therefore, the viability of the entrant—is left hanging. Even in the frictionless world of traditional

comparative statics, the original firm can cut its losses by reducing its own product mix, and in so doing undermine the position of the entrant. In a world in which an incumbent firm has an advantage because of established business patterns and information costs, an incumbent could undermine the position of an entrant simply by duplicating its product mix.

Although the authors of these papers (especially Panzar and Willig) exercise caution in drawing policy conclusions from their theoretical results, we are concerned about the improper policy inferences that might be drawn from this literature. The primary policy inference is that entry should be carefully scrutinized to ensure that society captures all the benefits of natural monopoly. In the context of a specialized model in which Ramsey prices are sustainable, Baumol et al. (1977) suggest that “the public interest is served by encouraging a monopolist to price in *anticipation* of entry rather than in *response* to it” (p. 360).

We have a number of problems with such policy prescriptions. As an empirical matter, strict global subadditivity is not likely to be convincingly demonstrated (or refuted), even in a world without technological change. That is, a single firm’s natural monopoly over all commodities and all output vectors normally cannot be verified on the basis of the data that are likely to be available. Indeed, this is the heart of the problem. Theoretical analysis can assume subadditivity, but policy application requires that regulators know whether a monopoly is natural over the relevant commodity space. If the monopoly is natural, a single regulated firm can be more efficient and an exclusive franchise may make sense (with the assumption that the regulated monopolist will be efficient). However, if the cost function is not known with certainty, as seems likely in most cases in which the issue arises, the imposition of entry restrictions may allow the monopolist to provide products that would be provided more efficiently by separate firms. This is of particular concern in a world in which the potential for process and product innovations is great and where a regulated firm’s profits are not regulated perfectly. In addition, requiring a potential entrant to prove that the monopolist does not have a cost function that exhibits strict global subadditivity is a burden of proof that is likely to be almost impossible to meet.

Another difficulty with erecting entry barriers is that a protected monopolist has less reason to engage in efficient practices. For example, Ramsey-optimal prices are not likely to be preferred to some other break-even price vector. Moreover, when demand functions are not independent, Ramsey-optimal prices will be extremely difficult for a

regulatory agency to calculate and enforce. In addition, entry restrictions reduce the impetus for least-cost production and cost-reducing technological change that might result from the threat of competitive entry. Even if a potential entrant intended to produce a new product, bearing the burden of proof that the product was indeed new would not only impose costs and delays but also would provide information that would help the monopolist prepare a competitive response.

In short, the theoretical results that have been derived in these papers do not sustain a general argument for entry restrictions into markets presently served by regulated monopoly firms. As yet, the theory is too specialized and insufficiently operational to support such a strong policy conclusion.

The only empirical application of the sustainability models that we are aware of is a paper by Baumol and Braunstein (1977) on the industry that publishes academic journals. That study found that the cost function in this industry is subadditive, and that costs could be reduced by concentrating the industry. The authors did not propose the establishment of a regulated monopoly for publishing academic journals; the absence of such a conclusion, for obvious reasons, illustrates the difficulty of deriving general policy implications from the sustainability literature. To have policy significance the model must be extended to incorporate complementary operational theories and empirical results on the issues of optimal product mix, relationship of product mix to market structure, and effect of market structure on rate and direction of technical change. The current value of the sustainability model is that it eliminates a shibboleth from the economics literature by demonstrating that one cannot prove theoretically that natural monopolies do not need a franchising process that protects them from entry. Whether entry restrictions are justified in any particular case is a largely empirical matter that depends on static and dynamic aspects of costs and product mix.

**Variable Pricing** In the literature on monopoly pricing, the one great practical triumph of theory is the work on peak-load (variable) pricing. (We prefer the latter term because recent developments in this literature have generalized the results beyond the case of the time-variant demand.) Beginning with papers by Houthakker (1951) and Boiteux (1951; 1960), a series of articles has steadily advanced the state of knowledge about an important practical problem: pricing in a situation in which short-term supply and demand conditions fluctuate so that, even when investments are perfectly efficient, an invariant price in all periods will produce

quantitatively important and recurring mismatches between demand and capacity (see Kahn 1970, chapters 3 and 4).

In complete detail the variable-pricing problem is very complex. On the demand side, the position of the demand curve varies continuously over time. Some sources of time-dependent demand are regular and predictable, but others are not; thus, the quantity demanded at a given price is a random variable, drawn from a distribution function with time-dependent parameters. On the supply side, the firm has several different technologies it can use to produce output, each of which has unique long-run and short-run cost characteristics. Supply, too, is a random variable in that, in the short run, a particular technology may be operational only at less than full capacity; a plant may shut down unexpectedly, or the sun may fail to shine on solar collectors.

The institutional constraints on the pricing problem can also vary. The goal may simply be economic efficiency, but it may include upper and lower bounds on the profitability of the enterprise. Moreover, the firm may be allowed to adopt price structures of varying complexity for example, by adopting multipart tariffs, or by segmenting customers into various groups, each of which faces a different price structure. And, of course, each of the institutionally feasible pricing systems has an implementation cost, such as the metering devices necessary to initiate time-dependent pricing. Finally, institutional arrangements to deal with excess demand must be incorporated into the model if prices and demand cannot vary instantaneously; examples of this are random rationing, preplanned rationing based upon value of service, and temporary elimination of service to some users.

As stated, the variable-pricing problem has not been solved, although several problems that bite off a large chunk of it have been. One strain of papers, including Houthakker 1951, Boiteux 1951 and 1960, Steiner 1957, Hirschleifer 1958, Turvey 1968, Wenders 1976, and Panzar 1976, established the basic peak-load-pricing results. These papers deal with cost functions and variable-demand relations in which time dependence is known with certainty. They address pricing problems that are concerned only with economic efficiency, unconstrained by revenue limits, but with the institutional constraint that in each period a single price applies to all units of output. (This price can vary from period to period.) These papers provide successively more refined definitions of the appropriate concept of marginal cost and versions of the basic result that prices ought to equal marginal cost in each period.

The most interesting generalization of the basic peak-load problem

is the incorporation of random variation in demand and supply. French utility economists, especially Boiteux, have investigated this problem since the early 1950s. (See Dreze's excellent summary [1964]; see also Balasko 1974 and Joskow 1976.) Their concern, as well as that of Crew and Kleindorfer (1976), is to incorporate two additional features of demand into the optimal pricing model: the uncertainty attached to the quantity demanded at a given price at any time, and the social costs associated with a failure to satisfy all demand at the going price. This extension of the model produces two useful results: a marginal-cost pricing rule that incorporates expected marginal operating costs and expected marginal rationing costs, and an optimal-investment rule that, on average, produces excess capacity (the optimal reserve margin) even in peak periods.

The significance of variable-pricing theory lies in its practical importance. Pricing schemes derived primarily from variable-pricing models are employed in several European countries to sell electricity (see Acton and Mitchell 1977). In France, for example, the year is separated into five periods (winter peak, winter shoulder, summer shoulder, winter off-peak, and summer off-peak) with differing probabilities that demand will exceed capacity. Customers buy capacity rights for each period at different prices, and face an additional use charge per kilowatt-hour which also varies by period. The capacity rights specify the maximum amount of instantaneous power a customer is permitted to demand in each period, and revenues from the sale of capacity rights are an important factor in investment decisions. Inexpensive control and metering devices, and even continuous digital home displays of current and total energy use, are in widespread use. The U.S. government has financed peak-load-pricing experiments in ten states, and in about twenty states time-of-day rates have been either ordered by regulators commissions or proposed voluntarily by utility companies (see Joskow 1979a, 1979b).

The atypical success of the variable-pricing literature, in terms of its practical impact, is worth trying to explain. Most economists who work in applied areas such as the economics of regulation believe that economics has something important to say to practitioners, yet they often are frustrated by the snail's pace at which economic rationality creeps into actual practice. Park (1973) even assembled a book of essays that constitutes a lament for the impotence of economists in another area (cable television policy) — a lament that is equally appropriate to numerous other regulatory issues.

The reasons for the success of the variable-pricing literature are numerous, and no attempt will be made here to detail them (for details see Joskow 1979a, 1979b). But one interesting element is that well over half of the references cited in this section were written by people who were willing to work with utility managers and whose research is to some degree the result of successive confrontations of theory with reality. Most of the French authors work for Electricité de France, and in the United States many papers in recent years have been written by economists associated with one or more peak-load-pricing experiments or with Bell Labs. These economists have carried on the theoretical search for a general theory of optimal pricing, but their work has demonstrated two additional features: Great attention has been paid to bringing the assumptions of the models ever closer to the realities of operating a utility, and nearly all of the papers recognize the problems and costs associated with implementing a perfect pricing scheme and even provide some additional analysis on locating (in the manner of Baumol and Quandt 1964) the "optimally imperfect" scheme. Perhaps it is accidental that a literature with successes in practical application also has these characteristics, but we doubt it.

Before concluding our discussion of the regulation of natural monopolies, we must note that Demsetz (1968) questioned the basic natural-monopoly justification for regulation. He suggested that, even where technological considerations indicate that a single producer would be most efficient, the use of some form of competitive franchise bidding could prevent a natural monopoly from behaving like a classical monopolist. Williamson (1976) and Goldberg (1976) criticized this approach because of its simplistic and idealized notion of private contracting and the problems that might arise in structuring and enforcing private contracts for natural monopolies. Both of these papers try to examine the nature of the private contracting problems that may result, and suggest that many of the problems that may arise are similar to the kinds of problems that regulatory agencies must deal with. They suggest that regulatory agencies may be an efficient substitute for private contracting in certain circumstances.

The more expansive conceptualization of private contracting institutions introduced by Williamson and Goldberg raises serious questions about the utility of comparing the performance of actual regulated markets with idealized models of competitive market behavior that ignore the costs of private contracting. More extensive empirical investigation of the nature of private contracts in different economic

environments and of the costs of negotiation and enforcement would be useful for advancing our understanding of the costs and benefits of alternative institutional arrangements.

### **Environmental, Product-Quality, and Health Regulation**

The most vigorous recent extensions of government intervention are actions intended to improve the quality of the environment, of consumer products, and of workplaces. Agencies such as the Environmental Protection Agency, the Food and Drug Administration, the Consumer Product Safety Commission, and the Occupational Safety and Health Administration are having increasingly important effects on the economy. Rapid extensions of rate and entry regulation in the health-care sector by states and by the federal government have been accompanied by regulatory control, yet relatively little useful research on the behavior and performance of these agencies has been forthcoming.

A substantial amount of theoretical research into externalities, information costs, product quality, consumer misperceptions, and moral hazards underlies a theoretical case for government intervention in many of these areas. The empirical relevance of these market imperfections has proved difficult to document because the information that is needed to measure it cannot be easily inferred from market transactions. Even in the case of environmental externalities, which most economists agree require some form of government intervention, there is disagreement about the particular instruments to be used and the ability of government regulatory agencies to deal with the problem effectively.

**Environmental Regulation** The best-developed theoretical models in the area of noneconomic regulation deal with environmental external diseconomies. The theoretical characterization of the environmental problem is borrowed directly from the public-finance literature on collective goods, and is a straightforward application of Samuelson's classic paper (1954). What is special about the theory of environmental externalities is the rather interesting array of institutional interventions by government that have been explored in the theoretical literature.

If perfect information were available about the benefits and costs of alternative abatement strategies for every source of pollution, the problem, in both theory and practice, would be relatively uninteresting. With perfect, costless information, optimal source-specific standards could be legislated. The interesting aspects of the problem are related to the imperfect information about sources of emissions, the amount of pollution

at each point of reception, and the costs and benefits of abatement that a regulator faces. A regulator can know only imperfectly where pollution is created and received and whether a source is in compliance with a regulatory rule. Moreover, regulatory interventions generate more information about the relevant facts of environmental problems, so that changes in regulatory constraints have two objectives: to produce a more efficient result in their own right and to generate more information to guide further alterations in the regulations.

Most economic-policy analyses of environmental problems propose the use of negotiations and corrective taxes to "internalize the externality." Baumol and Oates (1971) set up the problem in a straightforward partial-equilibrium format, regarding pollution abatement as having costs to abaters (which generate a surrogate supply function) and benefits to recipients (which generate a surrogate demand function). The policy problem is seen as imposing an emission tax that balances at the margin the costs and benefits of abatement. Ayres and Kneese (1969) and Leontief (1970) set up specialized linear general equilibrium models which include environmental externalities and in which the appropriate taxes appear as shadow prices. The implementation of emissions taxes may have been advocated most cogently in the public policy arena in a series of monographs by Kneese and others at Resources for the Future (see, for example, Kneese and Schultze 1975).

A less popular "economist's solution" to environmental problems, and one that also relies on decentralized processes to achieve efficiency, is to create tradable licenses to pollute. Coase (1960) saw externalities as a problem in incomplete specification of property rights, over which polluters and recipients could, in principle, negotiate once rights were defined and enforced. Dales (1968) provided a discussion of tradable pollution licenses that is rich in examples of how such a system might be implemented. Montgomery (1972) formalized the theory of tradable licenses and showed the conditions under which a given amount of pollution abatement is accomplished at least cost by creating tradable licenses.

The fascination of economists with marketlike mechanisms to deal with environmental problems is particularly interesting in light of the largely negative theoretical results on the effectiveness of decentralized processes that have appeared in the literature. One set of problems, emphasized by Davis and Winston (1962), Montgomery (1974), and others, has to do with the thinness of each artificial market for a pollutant. As Arrow (1970) pointed out, the appropriate expansion of the set of

commodities subject to market transactions that would allow a competitive solution to the problem of efficient abatement is a separate market for each pollutant that is delivered to each receptor. If the number of receptors at one point is greater than one or if the number of polluters in any particular market is small, price-taking (Cournot) behavior is not likely to conform to actual firm behavior. This undermines the efficiency of both markets in licenses and iterative tax processes.

The second set of problems is that not all equilibria that are reached by an iterative tax scheme or private negotiations over well-specified rights are efficient, and that not all efficient equilibria are stable even if Cournot behavior is followed. The difficulty is that pollutants that reduce the productivity of other production processes (including "consumption" production processes of the type hypothesized by Lancaster [1966]) can never drive the marginal productivity of resources in other processes to zero, because firms (or people) can exit. This means that, in some range, pollution abatement must involve economies of scale and discrete exit or entry points (which must make the problem amenable to corner solutions). Noll and Trijonis (1971) pointed out that the earlier approach to calculating prices from general equilibrium models required one to assume either that pollution costs are independent of output or that the marginal costs of abatement are independent of pollution. Their extension of the Ayres-Kneese and Leontief models admits the possibility of unbounded effects of pollutants on costs. As Starret (1972) demonstrated in a more realistic model, an iterative tax can reach an equilibrium at relatively small amounts of abatement, yet the equilibrium may be dominated by higher levels of abatement (achieved with higher taxes) that capture the gains from scale economies. Moreover, Montgomery (1976) showed that the necessary conditions for an efficient solution to a bargaining process requires that pollutants enter all production and cost functions separately, and that this condition is inconsistent with the conditions for the existence in equilibrium of more than one pollution-producing and pollution-receiving firm.

In terms of the practicality of implementing environmental policies, the second set of criticisms is probably more important than the first. Because the full extension of the commodity space contemplated by Arrow (1970) is impractical, problems of thin markets are unlikely to loom large in comparison with other difficulties. Moreover, no one has seriously proposed (although the demand-revealing mechanism of Groves and Ledyard [1977] may be waiting in the wings) that receptors will be responsible for collectively deciding on pollution taxes or on the number

of licenses to pollute that will be issued, except through the imperfect mechanism of the representative political process. The practical problem is whether a sequence of tax or license messages to polluters will produce minimum-cost responses so that decisionmakers, using whatever magic is at hand, can measure the consequences of these iterations and locate an equilibrium that works efficiently, notwithstanding the effects of imperfections in political processes for aggregating preferences and in the definitions of separate pollution markets.

The economists' traditional scheme for using market mechanisms to correct externalities has rarely been utilized. Corrective-tax and tradable-license schemes have almost entirely taken a back seat to direct control of effluents or specification of particular control technologies (Jacoby and Steinbrunner 1973; Mills and White 1978). Part of the problem is that the economists who advocate these policy instruments have usually ignored the problems of information costs, administrative feasibility, and uncertainty that characterize the real world in which these policies must be applied. When economists have considered these factors, they have identified circumstances that lead to a preference for standards—even input standards—rather than decentralized market processes (Spence and Roberts 1976; Spence and Weitzman 1978). But this cannot be the entire explanation. Mills and White (1978) provided a fascinating analysis of the historical evolution of auto emission controls, and presented a convincing case that a workable tax scheme has been available and would have been superior to the course followed by Congress and the EPA. For some reason, there appears to be an administrative and political bias towards rules and standards and away from markets in the area of environmental control. Exactly why such a bias exists is unclear, but eliminating it appears to be a prerequisite to implementing decentralized methods in this area.

**Health, Safety, and Performance Standards** Economists have yet to invent a felicitous term for the grab bag of regulatory policies that fall under this heading. Nevertheless, such disparate regulatory activities as occupational licensing, product-safety standards, occupational-health regulation, and truth-in-packaging requirements do have a unifying theme: All seek to protect parties to private market transactions from making decisions that they will regret. In individualistic microeconomics, the conceptual basis for these interventions lies in market imperfections that are due to costly and inexact information about the consequences of economic decisions.

Conventional microeconomic theory was built upon the assumption of costless and perfect information about the characteristics of jobs and products and about the prevailing set of wages and prices. But, as Arrow (1963), Stigler (1961), and others have taught us, information is itself a commodity in that it requires resources to produce and can have economic value to decisionmakers. Moreover, the production and evaluation of information is empirically a very important economic activity, as demonstrated by Machlup (1962) and Porat (1977).

Economists have taken two theoretical approaches to exploring the microeconomic foundations that might, in principle, provide a rationale for various forms of protective regulation: to postulate an exogenously determined state of imperfect information that cannot be affected by individual economic agents, and to make information an endogenous commodity that enters production and consumption decisions.

In a model developed by Spence (1977), consumers misperceive the hazards of products and therefore take more risks than they would take if fully informed. A similar model of a labor market for hazardous jobs would yield too-ready acceptance of risky occupations. This approach has a hint of paternalism, in that the informational difficulty is really ignorance, and in such a state consumers or workers would not know what they wanted regulated—the better-informed would have to tell them. The exception is Hinich's (1975) model of food regulation, which incorporates an insurance system or a similar risk-spreading mechanism to pay for health care. As long as sellers of insurance cannot tell the difference between ignorant and informed individuals (see Arrow 1963), excessive risk taking (moral hazard) by the former will impose a pecuniary external diseconomy on the latter. Thus, the informed group pushes for banning risky products and workplaces in order to save the cost of subsidizing the medical care of the ignorant. One is left with the problem of explaining why regulation, rather than a change in the institutions for financing medical care, is imposed.

Oi (1973) took an approach similar to that of Hinich, but asked a different question with a different set of specialized assumptions. Oi assumes that producers may be legally liable for injuries suffered by consumers, but that they have no mechanism for knowing the damage costs associated with individual consumers. Consumers, on the other hand, are assumed to have perfect information about product risks, to know their expected damage costs, and to be able to obtain actuarially fair insurance at negligible cost. As a result, producer liability leads to an inefficient outcome because producers essentially must homogenize

a combined product and insurance policy across heterogeneous consumers. Strict consumer liability allows the consumer to purchase the optimal quality of product and the optimal insurance policy separately.

The analyses of Hinich, Oi, and Spence, though each is obviously specialized, clearly point the way for a more general theoretical model of the informational problem that could underpin protective regulation. Such a model would take account of the following two considerations: First, insurance companies might have as much difficulty as producers in separating individuals into homogeneous risk pools, and may be unable to write insurance contracts that avoid moral hazard. Second, producers might know nothing about differences among consumers in their susceptibility to damage, and consumers might be unable to figure out the *ex ante* risks of products or even which product was responsible *ex post* if they suffered an injury or illness.

The main weakness of models with exogenous information states is that they ignore the process by which agents gather and evaluate information. Facing a positive marginal cost of information, a rational agent purchases information up to the point at which the marginal gains from more informed decisions are balanced by the marginal cost of information. If the market for information is perfectly competitive, decisions will be "optimally imperfect" in the sense of Baumol and Quandt 1964. Unfortunately, as Davis and Kamien (1970) pointed out, the market for information does have one theoretical difficulty: Information is not completely a private good. Once knowledge is produced for one person, it need not be produced independently for others who might want to use it. Thus, if knowledge is priced to recover its full cost, its price exceeds marginal cost and some people may be excluded from using it who would be willing to pay the marginal cost of making it available to them.

In addition to the fact that it may support some sort of public provision of subsidization of information about product quality and workplace safety, the preceding discussion also admits the possibility that standards and bans make sense. The reasoning is that decisionmaking that is based upon the processing of complex information is time-consuming, and thereby has some shadow price. Moreover, if numerous individuals make essentially the same decision on the basis of the same information, and if the tastes of the individuals are identical, it would pay the group to elect one person to process the information, make the decision, and tell everyone else what to do (Colantoni et al. 1976). Of course, if preferences are not identical, delegation of decision power creates consumption inefficiencies because the person making the decision will lead others

to consume qualities of products and experience risks at work that are not the same as if each person had made an independent decision. Thus, standardization of workplaces and products to remove certain types of risks saves information-processing costs at the expense of creating some inefficiencies and administrative costs. The point at which a regulatory policy balances these costs at the margin represents what Cornell et al. (1976) identify as the optimal delegation of decisionmaking authority.

The empirical importance of these theoretical arguments is critical, yet is still largely unresolved, and perhaps unresolvable. If a public agency can collect, evaluate, and disseminate information more efficiently than can the private market, we have an argument for regulation in the form of public provision of information. But as a practical matter, to make the measurements required for such a judgment *ex ante* is quite difficult. Even *ex post* it would be difficult to determine whether the public provision of information is beneficial. The net effect of beneficial regulation should be to shift the demand for the regulated products outward by reducing the gross cost of the product to the consumer through a reduction in information-gathering expenses. If the increase in welfare at the prevailing market price is greater than the costs of providing the information through a public authority, society will presumably be better off. However, isolating demand shifts that are due to a reduction in the costs of information borne by consumers from changes in demand that arise from a myriad of other causes is likely to be a very difficult empirical task. On the other hand, while it will be difficult to determine a hard point estimate of the benefits of the public provision of information, a good upper-bound estimate for the net costs of such interventions ought to be possible. As long as the public agency does not provide incorrect or misleading information, the administrative costs of collecting, evaluating, and distributing the information will provide an upper-bound estimate of the costs of regulation.

The situations in which a theoretical case for standards can be made present even more difficult problems for evaluation in practice. The regulation of product quality (including the banning of certain products) requires us to know not only that a public authority can collect and evaluate the relevant information more efficiently than can individual agents in the market, but also that the more efficient use of these results is to set a standard or ban rather than to provide the information directly to consumers. This is a difficult case to make. Regulators are more likely to set the wrong standard than to provide incorrect information, for several reasons. First, with the information available, it may be extremely

difficult to determine the “right” product quality for all consumers. Second, agencies with responsibility and political accountability for regulating risky products are likely to be extremely averse to approving a product that results in some injuries or deaths, even if approval is an efficient decision. Third, the standard-setting process is likely to be more easily captured by some particular interest group, whether a consumer group that thinks people ought not to eat hotdogs even if they want to or a producer group that can use the standards as a means to help cartelize an industry by making entry and product differentiation difficult. In addition, standard setting is likely to be more costly, because it requires an enforcement mechanism to be effective.

We suspect that, in most situations in which public collection and evaluation of information is more efficient than the private market, the direct provision of this information to consumers will be a regulatory alternative superior to the establishment of standards and bans on products. Standard setting makes sense only in those situations in which a strong case can be made that the dissemination of information is extremely costly, or that consumers will find it difficult to use the information effectively. Thus, we find troublesome the propensity of agencies such as the Consumer Product Safety Commission to opt for setting standards rather than providing information.

In analyzing the effects of the 1962 amendments to the Food and Drug Act, Peltzman (1973) developed the following hypothesis about protective regulation: Effective regulation should reduce the amount of learning about product quality that takes place during the first few years a product is marketed. In particular, Peltzman argues that the demand for a new drug will decline more slowly with effective regulation because the agency will already have done some of the learning about the quality of the drug before it is marketed. McGuire et al. (1975) correctly pointed out that almost nothing can be concluded from an analysis of the aggregate demand for new drugs. Among other things, they question Peltzman’s assumption that all consumers make the same kind of error when purchasing new drugs. For example, without FDA scrutiny, physicians may not prescribe a new drug until more evidence of its effects are known. Such behavior would lead, over time, to movements of individual demand functions that would be just the opposite of those proposed by Peltzman, and could simply cancel out the behavior of those individuals who behave as Peltzman suggests when the aggregate demand function is observed.

We also believe that Peltzman’s analysis assumes that the linkage

between consumer preferences and observed drug purchases is much the same as that in a typical commodity market, such as the market for new soft drinks. This ignores a number of important, special characteristics of the drug market. First, individuals do not make direct decisions about what drugs to consume; their physicians do. While physicians, prescribing behavior is an unsettled area, serious questions have been raised about the ways in which physicians respond to drug prices and how they evaluate the information available about drug quality. Second, patients generally buy a package of medical-care services from a doctor or a hospital, with a large portion of the total cost borne by third parties. Consequently, the connection between consumer preferences and observed drug demand is indirect.

Peltzman raises another issue, concerning the effects of regulation on innovation. If a regulatory intervention requires prior approval before a new product can be marketed, the effect is to increase the cost of product innovations directly by requiring more research and indirectly by delaying initial marketing (see Grabowski and Vernon 1976). Peltzman (1973) argued that the supply reductions caused by the 1962 drug amendments led to a reduction in the growth of demand for drugs after 1962. We infer that the source of a connection between supply limitations and the position of the demand curve that Peltzman has in mind is that some areas of the product space have been excluded by regulation, so that an aggregated-demand curve for all drugs in the two periods actually spans a different product set. A reduction in the number of drugs on the market, according to this conceptualization of the problem, would cause the representative consumer to find a greater distance in product space between the most desirable drug in principle and the closest approximation to it in reality. Even if this is so, to conclude that a backward shift in the demand curve for drugs represents a loss in welfare is not justified. Because drugs are supposed to treat illness, one source of the reduction in the demand for drugs could be that drugs are more effective, on average, in curing treatable illnesses. Or, perhaps fewer people have to be treated for illnesses arising from taking bad drugs. In short, an improvement in the quality of drugs does not necessarily mean that drug sales will increase, particularly if the improvements take the form of replacements for less effective drugs that required greater dosages.

Data problems have plagued attempts to evaluate consumer-protection regulation in areas other than drugs. Starting in the late 1960s in the Food and Drug Administration and continuing since 1973 in the Consumer Product Safety Commission, the federal government has



collected a great amount of information on hospital admissions and emergency treatments for injuries sustained in connection with the use of an extremely wide array of consumer products, encompassing even athletic equipment used in organized sports. Though some accident reports are followed by intensive investigations of the cause of the injury, for the most part the data leave open the cause of an accident. For example, an accident would be chalked up to the "processed foods" category if a person broke a toe by dropping a can of corn as well as if the can exploded without apparent provocation. Moreover, because data on the use of products are not collected, neither scholarly research nor safety-regulatory agencies have been successful in allocating the change in accidents associated with a product among changes in the hazards inhering in a product (such as might occur when a regulatory rule is imposed) and changes in the use of a product (such as might occur if safety regulations increased the price of the product substantially). (This argument was advanced by Cornell et al. [1976].)

Even in the area of automobile safety, which has somewhat better data spanning a longer period of time, the empirical analysis of the effects of safety regulation is controversial. The most detailed study (Peltzman 1976a) attempts by time-series analysis to detect the effect of safety regulations on automobile accidents. Peltzman's interesting insight—which is applicable to all safety and health regulation—is that the imposition of protective regulations might cause consumers to engage in more risky behavior, thereby offsetting some of the potential effectiveness of the regulations. The difficulty in trying to test the empirical importance of this argument is that it requires a complete specification of the process by which the riskiness of an activity is determined. In the case of auto safety, not only can cars change, but so can the physical layouts of roads, the attentiveness of the driver, the amount of safety-related maintenance the car receives, the driver's selection of driving speed and route (a safe, indirect interstate or a dangerous but direct county road?), and, for reasons other than safety of the automobile, the composition of the driving force. The task of convincingly taking account of all of these factors is monumental, and the discussion by Manne and Miller (1976) of Peltzman's attempt reveals that consensus was not reached.

In the area of occupational safety, relating workplace hazards to wages and relating safety standards to injuries have proved easier to accomplish, and economists are in general agreement that OSHA has probably generated more costs than benefits. Although some empirical work on the effects of OSHA regulations has been undertaken, the professional

consensus on the effect of the agency rests primarily on more indirect evidence. R. Smith (1976) summarized a series of studies that he and others carried out for the Assistant Secretary of Labor for Policy, and presented some new information that attempted to quantify the aggregative impact of OSHA standards on industrial accidents. He found no measurable impact. R. Smith and the staff of the Council on Wage and Price Stability also undertook several benefit-cost analyses of specific OSHA standards, and concluded that the price tag on these regulations is also probably too high. For example, Smith (1976) estimated that workers would have to value reductions in hearing due to current noise at approximately \$15,000 to make the standards worthwhile.

One difficulty with these empirical studies is that the data on industrial accidents are notoriously poor. Experience rating for workmen's-compensation insurance gives employers an incentive to pay off injured workers and not report accidents. The problem of analyzing the impact of OSHA regulations was compounded by a change in Department of Labor injury-reporting procedures that occurred approximately at the same time OSHA was created. Even with reliable injury statistics, estimating the costs of accidents and of avoidance strategies is difficult. As an example of the empirical problems on the benefit side, the evaluation of the noise abatement standards uses data on the relationship of values of property near airports to decibels of noise from airplanes to measure the disutility of noise in the workplace. A few of the assumptions implicit in this approach are that the undesirability of noise in properties near an airport is the same as the undesirability of noise in a workplace; that the disutility of noise is measured by a scalar (loudness) and is unrelated to frequency, intermittency, and other measures of noise; and that a linear relationship exists between the monetary value and the amount of noise (this last assumption is known to be inaccurate, for example with respect to the relationship between hearing loss and noise). Yet, even after these criticisms have been made, one is at a loss to propose a distinctly better method. One can expect to obtain only indirect evidence on the disutility of noise or most other sources of work-related injuries by observing transactions in labor, product, and property markets. Consequently, benefit-cost analyses of proposed standards, though useful as a device to organize thought and evidence, are unlikely to prove definitive in determining the value of a standard.

The best economic arguments against OSHA have to do with the agency's selection of regulatory targets and with the enforcement of its standards. Cornell et al. (1976) inferred from theoretical arguments in

favor of regulatory interventions that the more complex the problem of processing information about a hazard, the more likely that a standard (rather than an informational requirement) ought to be adopted. They concluded that OSHA appears to select regulatory targets not on this basis but by the frequency and severity of injuries. Because workers and employers are more likely to have given attention to dealing with frequent, severe accidents, the likely regulatory impact here can be expected to be small, especially if the problem is relatively easily comprehended. These authors and R. Smith (1976) point out that the theoretical case for intervention is stronger for long-term occupational health problems, but that OSHA has focused relatively little attention on these. Both studies also discuss the feeble incentives for complying with OSHA standards that existing enforcement policies provide. Although the situation varies from industry to industry, most firms can expect an OSHA inspection about once a decade. For firms found out of compliance, fines average about \$170 (for an average of about six violations). Compared to the costs of compliance, the expected losses from being found out of compliance are minuscule; consequently, there is little reason to expect much compliance, or much of an effect of OSHA regulations on injury rates.

One approach to the use of incentives to deal with occupational safety problems is to raise fines for noncompliance and rely primarily on an inspection system. Another is to tax injuries, as proposed by R. Smith (1974), and rely on injury reporting to establish the basis for the tax. Because accurate reporting of injuries is problematical, this too would require checking, although perhaps the costs of inspection would be lower for checking injury reports. Nevertheless, the primary advantage of the tax approach is said to be that the regulator does not need to know the details of injury-prevention technology, just as the environmental regulator need not know the details of abatement technology, to impose a tax on performance. This raises the issue of whether a tax equilibrium is necessarily efficient, if regulators adopt the same sort of iterative procedure that was proposed for emissions taxes. To our knowledge, this problem has not been addressed in the literature on occupational safety. We conjecture, however, that a tax equilibrium would be efficient except for two eventualities: The cost function for injury reduction may not be convex, so that tax equilibria may be a local but not a global optimum, and the pecuniary externality associated with the cost-sharing features of health and liability insurance may introduce a further nonconvexity with the same effect as the real external effect on production that is associated

with pollution. In addition, the problems raised by Spence and Weitzman (1978) remain, and under certain circumstances these could tip the balance in favor of standards.

The remaining major area of product quality regulation is occupational licensing. The public-interest rationale for occupational licensing is the protection of poorly informed consumers from incompetent practitioners. Economists have long been skeptical of the value of entry barriers in any market, and occupational licensing, especially by self-regulatory processes such as qualifications exams, is no exception. Stigler (1971) argued that occupational licensure is solely a device to restrict entry so that the practitioners of licensed professions can earn more. Benham (1972) and Benham and Benham (1975) showed that eyeglass prices are higher in states that regulate or prohibit advertising by optometrists, and Plott (1965) found that licensing dry-cleaning establishments has a similar effect.

Because the public-interest purpose of occupational licensing is to raise the quality of service, the effects on prices and wages that have been found are not surprising. The key to whether this form of regulation benefits only members of the protected occupational group is whether service quality is higher in states with stricter regulation and, if it is, whether consumers are being denied access to lower-quality services, which, with the relevant information, they would prefer to purchase.

On *a priori* grounds one would suspect that quality is not improved by entry restrictions, because so little of the regulatory effort is directed at issues of quality. Occupational licensing is usually for a lifetime, whereas a system designed primarily to ensure that practitioners were competent would subject professionals to periodic examinations. Moreover, as Benham (1972) pointed out, the American Optometric Association places very little weight on indexes of professional competence in deciding whether a member is in good standing; instead it allocates most of the weight to whether the member abstains from advertising.

Nevertheless, scientific evidence on the quality issue is surprisingly sparse. McCarthy et al. (1977) examined the quality effects of board certification of surgeons by investigating the frequency of nonconfirmed recommendations for elective surgery based on second-opinion reviews. The rate of nonconfirmation does not differ significantly between board-certified surgeons and those without board certification in their sample, indicating that licensing has little effect on this aspect of quality. Benham (1972) reported some comparisons of the cost of filling a given prescription for eyeglasses in regulated and unregulated states, but his evidence

must be regarded as anecdotal. Benham and Benham (1975) entered measures of the absence of regulatory control into their equation for the demand for eyeglasses. Although they estimated this equation for other purposes, one use of such a specification would be to test for quality improvements due to regulation. Better service might be expected to increase the demand for eyeglasses, in that a greater number of marginal cases would opt for glasses and people from adjacent jurisdictions would seek the higher quality available in the regulated state. On the other hand, because glasses are durable goods and because eyesight changes over time, better service might lead to glasses that provided acceptable correction for a longer period of time, thereby reducing the time rate of demand. Benham and Benham (1975) found that measures of the absence of regulatory controls, while not significant by conventional standards ( $t$  statistics of 1.2), all have positive signs—that is, demand at a given price is higher in states with less regulation. They also found that the price effects of regulation reduce sales by about one-third. Though these results argue against the possibility that quality effects due to regulation offset the price effects, they are not definitive; the greater sales in the absence of regulation could be lemons.

In the absence of additional studies of the actual effects of licensing in particular professions, the case against professional licensing remains scientifically unproved. On the other hand, for many occupations, serious skepticism continues to be warranted, especially where quality does not appear to be a condition of the license.

### **Conclusions on Environmental, Product-Quality, and Health Regulation**

Research associated with issues of the environment, health, and product quality is, in a very real sense, the frontier of regulatory research. On a practical level, these are the areas in which regulatory efforts have expanded the most in recent years. On the theoretical level, an increasing amount of research effort has gone into evaluating the behavior of economic agents in regimes where information is costly or imperfect or where consumers may be misinformed about the attributes of the products they are purchasing. These efforts have served to identify a variety of situations in which some form of collective action appears to be appropriate or where changes in existing liability rules may be called for. The possible instruments for government intervention vary widely and include the collection and dissemination of information, the establishment of standards, the use of taxes or subsidies, and more reliance on producer

liability. The particular instrument favored depends (not surprisingly) on the particular assumptions made in the theoretical work.

Empirical work directed toward identifying situations in which additional government intervention may be called for and toward evaluating existing regulatory efforts has made less progress. Some valiant efforts have been made to come to grips empirically with the costs and benefits of these forms of government regulation in certain industries; however, the data required for making a convincing case are extremely difficult to obtain from information on market transactions. In addition, the empirical work has not kept pace with theoretical developments to the extent that the particular types of market imperfections that regulation might be directed toward have not been adequately incorporated into the empirical analyses that seek to test whether the benefits of regulation outweigh the costs. The empirical difficulties are associated with the need to include price, quantity, *and* quality space. The relevant quality attributes are difficult to measure, and optimal price, quantity, and quality combinations are difficult to infer from market transactions if informational and perceptual imperfections contaminate unregulated-market transactions.

The existing theoretical and empirical work is not without value. Although research has not provided much information on whether regulation is appropriate, it has helped to answer the question whether, if some set of transactions are to be regulated in response to some perceived market imperfection, there are better and worse ways of going about it. In the noneconomic regulatory areas, the tools available to the economist appear to be better suited to identifying means for improving regulation than to arguing whether regulation should be imposed. The theoretical and empirical work done thus far is directly relevant to the former issue, as is much of the work by economists and other scholars on other regulatory agencies that attempts to identify the kinds of thing that administrative agencies do relatively well and those things that they do relatively poorly. Indeed, we advance the general proposition that far too much of the effort of economists has been directed toward asking whether there should or should not be regulation, and far too little effort directed at how to improve the performance of regulatory policies.

### **Theories of Regulation**

The litany of possible market failures contained in the preceding sections constitutes a normative theory of regulation that had great appeal among economists until the 1960s, and still is often the beginning assumption

of research on regulation. The essence of this normative analysis as a positive theory is that one begins an analysis of a regulatory process with the assumption that its purpose is to maximize some universal measure of economic welfare, such as consumers' surplus or total surplus.

As a positive theory of regulation, the normative theory of welfare economics is obviously incorrect. Economists have demonstrated that regulatory agencies make numerous decisions that reduce conventional measures of economic welfare. The reasons for the failure of the normative theory are two: First, individuals have objectives, such as guarantees of procedural fairness, constitutional freedoms, and pleasant human relations, that are affected by the actions of regulatory institutions but are not yet accounted for in applied welfare economics. Second, political agents are economic actors, as are producers and consumers, and they respond to incentives created by political institutions and administrative processes. For both reasons, a rational regulator would be unlikely to seek to maximize conventional measures of economic welfare.

General theories of regulation tend to be either legislative or bureaucratic, in that they select either the electoral process and the incentives operating on politicians or the bureaucratic process and the incentives operating on regulators as the focus of analysis. In the first category is the "Chicago School" of regulatory theory, the outstanding proponents of which are Stigler (1971), Posner (1971, 1974), and Peltzman (1976b). The essence of their theory is that regulation is a device for transferring income to well-organized groups if the groups will return the favor with votes and contributions to politicians. The theory predicts that regulators will use their power to transfer income from those with less political power to those with more. Precise *a priori* predictions of the direction of this income redistribution are impossible, because it depends on the costs and benefits of regulation as perceived by different interest groups and their ability to exercise their power in the political arena.

In a world with perfect information and self-interested voters, there is no natural reason why regulatory intervention is a majority-rule equilibrium (assuming preferences are distributed in such a way that such an equilibrium exists). In politics, organizations and contributions matter because they affect voter information and motivation; consequently, a legislative theory of regulation must have some theoretical connections to the electoral process. Once that connection is made, the door is opened to political entrepreneurs who seek power rather than economic payoff, and who pay the informational costs of communicating messages to the unorganized voters who are "done in" by the Chicago School

regulator. This possibility limits the extent to which regulation can impose costs on the general population, but does not completely offset it because the costs would have to exceed some minimum amount before voters could be induced to make them a primary motive for political participation.

Of the theories of regulation that focus on the agencies themselves, most also predict outcomes favorable to organized interests. Noll (1971) argued that the committee structure in Congress, the mechanism of judicial review, and the administrative process all favor well-organized interests. Arguing one's case in a congressional, regulatory, or judicial hearing is expensive, so organized groups that possess resources to expend in this manner can be expected to influence policies to the extent that the outcomes depend upon the information presented in these processes. Bernstein (1955) propounded a life-cycle theory of agencies in which they "age" from active advocates of generalized consumer interests to passive conduits of the interest of organized groups. Eckert (1972) proposed a more direct form of capture: that regulators expect to become employees of organized interests when their regulating days are over. The U.S. Senate Committee on Government Operations (1977), after examining data on employment histories of regulators, concluded that conflict of interest of this sort was enough of a problem to warrant proposing to prohibit employment of former regulators in regulated industries for one year after their terms expire.

Not all structural theories of regulation are pinned to interest-group aggregation. Michelman (1967) proposed that judicial processes, like administrative reviews, serve an important psychological function by giving people their "day in court." Williamson (1970) applied this general framework to price regulation. The argument is that normal market processes (because of the variability of market equilibrium) and governmental interventions to improve efficiency can cause arbitrary and capricious redistribution of income. Administrative processes are a mechanism for ameliorating these redistributions, but they are also processes for defusing destructive psychological responses to capricious redistribution. Through participation in administrative processes, people derive benefits through reduced demoralization should they have their say and still lose. The interesting, unique feature of this theory is that it attempts to incorporate noneconomic aspects of individual welfare into a theory of economic welfare, setting up the possibility of a tradeoff between economic efficiency and psychological well-being. The theory is not inconsistent, therefore, with theories emphasizing bureaucratic

and procedural bias in favor of well-organized groups. The latter could be viewed as the cost of providing other forms of noneconomic benefits.

Because bureaucracies are created and supported by legislatures, a complete process theory of regulation must be connected to electoral politics. For theories oriented toward interest-group influence, the key issue is why legislators want to create regulatory institutions that are excessively oriented toward the welfare of well-organized groups. Thus, one way to view bureaucratic theories is as natural extensions of a legislative theory. Questions concerning the operation and organization of agencies would then no longer be central to the concern of the political economist, just as questions about the structure of a competitive firm are not very interesting to the economists who studies a perfectly competitive industry.

A second electoral connection, separated from a pure model of interest-group politics, was proposed by Fiorina and Noll (1978). They argued that a national legislature composed of representatives from single-member legislative districts creates a prisoner's dilemma for voters and legislators: A legislator becomes one of many voters on public-policy issues affecting the welfare of all voters, but is a monopolist in filling the role of an ombudsman for constituents (that is, in providing information about public activities and intervening informally in government processes by virtue of oversight activities on behalf of the home district). To be a good facilitator for constituents, the legislator must be in a position to reward helpful bureaucracies, and therefore must not be a consistent opponent of bureaucratic policy. A voter in a district can be in a prisoner's dilemma if the electoral choice is between an opponent of regulation and a proponent who is a good facilitator. The former, as one small voice in the legislature, is unlikely to effect a change in policy; hence, the payoff to the voter is greater if the proponent of an undesirable policy is elected because in that case, the voter will receive at least some return from the policy (though not enough to offset its cost).

The structure of the regulatory process assumes importance in this model, because it determines the extent to which the congressman ombudsman can influence its outcome by informal interventions. Administrative law can be interpreted as an attempt to escape from the prisoner's dilemma—a set of formal procedural and evidentiary rules that limit the ability of a representative to convert regulation into porkbarrel, but that raise the costs of participating in the process.

General theories of regulation have two major conceptual difficulties. First, they are extremely difficult to separate from even more general

positive theories of representative democracy. Regulation is typical of government policies in that regulatory actions affect both economic efficiency and the distribution of income, in that an important part of both effects is on some well-organized groups, and in that regulation is carried out by a bureaucracy according to the tenets of administrative law. General theories have not yet explained why politicians sometimes choose regulation but at other times choose other instruments of public policy to distribute the favors of a pluralistic democracy, nor why the inefficiencies of a regulatory bureaucracy differ from those of bureaucracy generally. The second problem is that the inherent inefficiencies of regulation that flow from these theories have no natural normative consequence, although one would not deduce this from the tone of the literature. That regulation fails to reach a Pareto optimum is fairly uninteresting if no institutions exist that can reach a point that Pareto-dominates regulation. For regulatory interventions that deal with empirically important market imperfections, the departure of regulatory equilibrium from perfect competition is not normatively compelling.

General theories of regulation face an empirical problem as well. The pluralist theories are built upon comparisons of the economic stakes, the degree of organization, and the resources of the interest groups, yet these variables have proved especially difficult to measure. Empirical tests of interest-group theories inevitably boil down to an estimate of the distribution of costs and benefits of an interventionist policy that is based on the departure of regulated equilibrium from perfect competition. Examples include the study of railroads by Spann and Erickson (1970) and Stigler's (1971) empirical tests of his initial statement of the Chicago School theory. The way in which these theories have evolved makes rejection of the null hypothesis virtually impossible, because the empirical information that is used to test the theory is also the information available to identify the successful interest groups. In the absence of any clear way to reject the hypotheses presented, the theories can easily become tautological. A nontautological test of interest-group theories would go one step farther, to correlate measures of the *ex ante* political influence of a group with its *ex post* net benefits from regulation. Moreover, it could use influence measures to explain the absence of regulation where that is the case.

Because of these conceptual and empirical problems, theories of regulation must still be accorded less than full scientific status. Social scientists have not yet shown convincingly that they understand what political purposes are served by regulation, why some industries are regulated and others are not, and why regulatory controls rather than

other policy instruments are selected. Until answers to questions like these are forthcoming, the theory of regulation serves as a convenient way of organizing historical material, but not one that is particularly rich in predictive value.

Despite these reservations about the theory of regulation, this research has played an important role in shaping our conceptions of regulation. It reminds us of the impossibility of a free lunch. Curing a market failure by regulatory intervention generates costs as well as benefits because, owing to certain features of political and bureaucratic institutions, regulators cannot be expected to stop just at curing the market failure. General theories also raise issues that must be faced by those who would reform, rather than abolish, regulation. Presumably, only by asking fairly general questions about regulation can scholars ascertain what purposes regulation serves from the viewpoint of political and bureaucratic actors. Understanding these purposes is a prerequisite to predicting the effect on policy outcomes of a change in the instruments of policy.

Very little research is available on the comparative outcomes of different regulatory institutions. Scholars have expressed opinions about the importance of such issues as the size of a commission, the location of an agency in governmental hierarchy, the form of procedural and evidentiary rules, financial support for consumerist intervenors, and the subcommittee structure in which congressional oversight takes place; however, little scientific research on these issues has been undertaken. Consequently, political actors who seek to make regulation work better can find very little of interest in the scholarly literature either to show them how to reform the process or to convince them that nothing is really likely to improve matters. For those who believe that regulation is never appropriate the absence of comparative institutional analysis is hardly a loss, but to those who believe some regulation is desirable or simply inevitable the absence of guidelines on how to accomplish it most efficiently is an important void in scholarly research.

### Promising Directions for Research

The preceding section summarized and evaluated four main lines of inquiry in the economics of administrative regulation. Certain lines of research have led to important results that provide a deeper understanding of the effects of regulation on firm and industry behavior and generate useful information for making public policy. Other lines of research have been less productive, and represent difficult conceptual and empirical chal-

lenges for economists. Because government regulation has become an increasingly important factor in our economy, and many important questions remain to be answered, scholarly interest in regulatory economics will continue and even increase in the future.

Because it has been a theme of this article that the returns on the traditional theoretical and empirical tools used for analyzing government regulation are diminishing rapidly, we bear an obligation to discuss what we consider to be fruitful lines of future research. We do not intend to provide a comprehensive research agenda. The discussion reflects our own research interests, and focuses on work that would be responsive to the issues raised above.

Research on regulation has two potential values. One is purely scientific: Research can increase knowledge about human behavior and institutions, even if it adds nothing to the ability of humans to control their destiny. The other is practical: Research can help political actors (voters, politicians, and bureaucrats) make decisions about public policy. Research on the economics of regulation generally falls more into the first category than into the second. Scholars have formulated reasons why society might decide to override markets, and considered the problems that society's agents may face in attempting to intervene. But, except for the literature on price regulation of competitive industries and peak-load pricing of public utilities, regulatory research has not contributed much to the debate about how to deal practically with the issues that give rise to a demand for regulation, or even whether in specific situations the issues are important enough to bother with. The one general, practical accomplishment of research on regulation is a healthy skepticism about the ability of regulatory agencies to deal easily and effectively with perceived market imperfections. At the very least, research on regulation has made life more difficult for anyone who suggests a regulatory initiative without carefully thinking through the problems that it might entail in practice. But scholars should be able to accomplish more than this.

The preceding remarks are not intended as an indictment of the research community, for the technical methods necessary to deal with practical regulatory problems are only now being developed. Economics as a predictive, empirical science is a very new and rapidly developing discipline. Political science, which we believe also to be relevant, is even less mature, as is the branch of psychology that deals with decisionmaking. Just as scholars of regulation made substantial breakthroughs a generation ago by applying standard neoclassical welfare economics and statistical methods for socioeconomic data to some issues of regulation,

the next generation of regulatory research scholars may advance knowledge (especially practical knowledge) substantially by building on several developing areas of research in economics, in political science, and in psychology.

### Information

The most fundamental theoretical problems in research on regulation concern making decisions with incomplete information. Among economic theorists, the decade of the 1970s was the era of the economics of information. Theorists have explored several nuances of two related questions: Given a state of knowledge about contingent events, what action will a rational decisionmaker take? How does a rational decisionmaker decide to stop acquiring more information, which is costly, and make a decision? Both these questions are central to an understanding of regulation. Much regulation is justified on informational grounds, and the very existence of administrative processes is testimony to the uncertainty that pervades regulatory decisionmaking. Consequently, the better the theory of decisionmaking under uncertainty, the better will be research on the rationale, process, and effectiveness of regulation.

Research on the economics of information has progressed since Stigler's path-breaking 1961 paper, but the literature still lacks general results. One major problem is that an optimal search procedure for gathering information has not yet been identified. Gastwirth (1976) showed that sequential-search strategies dominate optimal-sample-size strategies, but the results in sequential models depend upon the existence of a reservation price with which each sample price is compared. In search models it is not clear exactly where reservation prices come from for buying is an occasional, discrete event (not a continuous rate of consumption, as in consumer theory). Several buying events can occur at different times and prices, and the frequency can be varied to alter time rates of consumption. Thus, there is no natural connection between purchase decisions and the reservation price associated with any particular rate of consumption. Moreover, "comparison shopping" is a nonsequential process, and consumers are known to use it, as Bettman (1977) pointed out. Once one admits nonsequential processes and assumes that consumers do not know in advance the distribution from which samples are being drawn, there is no foundation in preference theory for selecting any particular sampling process. In addition, as Wilde and Schwartz (1979) showed, in order for there to be a competitive equilibrium price in such a model some consumers must be willing to continue to search

after they can capture no further gains from additional information—in other words, search must be consumption rather than investment.

Another source of difficulty in the literature on the economics of information is that the two behavioral foundations of the current theory of decisionmaking under uncertainty—expected utility maximization and Bayes's Rule—probably do not properly characterize actual decisionmaking. Grether and Plott (1979) showed that, in situations involving probabilistic risk, fully informed experimental subjects exhibit intransitive preferences, even when the stakes are quite high; Grether (1978) showed that in similar kinds of situations people do not update probability information according to Bayes's Rule. These two papers bring into serious doubt the basic assumptions of both search models and decision theory.

These findings are shocking to economists, but they are well established in experimental psychology. Mathematical psychologists have been attempting to construct a new approach to decision theory that is consistent with these findings since the early 1970s. The most interesting idea thus far—"elimination by aspects"—was proposed by Tversky (1972), who suggested that individuals solve decision problems involving uncertainty by first classifying a problem according to what appear to be its essential features, and then applying a general decision rule that, through experience, has proved effective in that particular category.

This model is similar to the model proposed by March and Simon (1959) in the context of organizational decisionmaking. March and Simon saw as the first step in organizational problem solving the "factoring" of problems into subelements, each given to a responsible individual to suboptimize, and viewed the ultimate decision as an integration of a series of partial solutions. The key feature of both the Tversky individual model and the March-Simon organizational model is the simplification of complex problems into something that is easier to solve but that does not necessarily produce optimal or even consistent results.

The implication of the Tversky hypothesis is that the solution that people will develop to problems involving incomplete information will depend upon the particular context in which the problem arises. One inference to be drawn from this hypothesis is that scholars should concentrate on developing a series of special theories dealing with different types of informational problems without being concerned about logical inconsistencies among the special theories. Thus, a model that describes individual behavior in the face of uncertainties about product quality may have little in common with a model that does a good job in describing

job search in the absence of workplace risks, and the latter may have little in common with models that deal adequately with the response of employees to hazards in the workplace. A second inference is that if government intervenes to change the state of information in a substantial way, two effects need to be predicted: how the new information changes performance according to a particular decision rule, and how the new information might change the context of problem solving in a way that would cause individuals to change the decision rule that was applied to the particular situation.

Whether Tversky's hypothesis is ultimately correct or whether a general theory of decisionmaking with incomplete information eventually emerges, the implication for scholars of regulation is pretty much the same. No generally theory is in the offing, important policy issues are now being decided on the basis of presumptions about the role of information in economic decisions, and special theories appear promising in the short run. A special theory of product choice with incomplete information and government regulation would be especially important in this context. Either this or a model of labor-market search (with wages, not hazards, the source of uncertainty) is likely to be the first practical problem in the economics of information to be solved. Substantial information already exists in marketing research on how consumers respond to various kinds of information; product-market-search models are proliferating. The next major step will be to incorporate formal characterizations of regulatory interventions into these search models and to devise methods for empirical tests of the theories.

### Dynamics

Another major void in economics that has potentially important implications for the study of regulation is the theory of disequilibrium price dynamics (how fast a disequilibrated market returns to equilibrium, and the path of disequilibrium transactions as equilibrium is approached). Alternative market organizations are inevitably compared in terms of their equilibrium properties. This procedure makes sense if markets spend most of their time on an equilibrium price path; however, if random, exogenous events regularly cause supply-and-demand relations to shift in ways that can only be known in a statistical sense by economic agents, price dynamics can be an important element in determining the efficiency and distributional consequences of a market.

Arrow and Capron (1959) developed a simple theory of disequilibrium price paths when demand is shifting outward. With either a linear Wal-

rasian adjustment process or adaptive expectations, the predicted disequilibrium path of transactions traces a price line that rises at a constant rate that never reaches market equilibrium, and that approaches a constant, limiting proportion of excess demand. V. Smith (1964) tested the theory in an experimental setting in which participants received monetary payoffs that were designed to induce normal market incentives, and found that the three predictions of the theory were not borne out by the results.

One source of the incompleteness of current theory is that the price-dynamics problem involves the formulation of expectations and the consummation of transactions that are based upon uncertain information, which places the problem in the unsettled realm of information economics. But V. Smith (1976) showed that out-of-equilibrium transactions persist in an experimental situation designed to represent perfect competition (one where only buyers reap surplus from market transactions and all actors know the reservation prices of everyone else). Smith hypothesized that when sellers can obtain no surplus, interpersonal comparisons of utility that would otherwise be suppressed begin to enter selling decisions, causing buyers to begin to offer inframarginal prices that differ from equilibrium according to the extent to which they are less favored by sellers.

The importance of this work to scholars of regulation is that different market rules produce different amounts and flows of information among participants in the market, and this, in turn, can affect the pattern of disequilibrium transactions. The key issue is whether a particular method of exchanging price/quantity offers among buyers and sellers allows, in disequilibrium, one side of the market to capture rents from participants on the other side who happen to have relatively intense preference—that is, who stand to capture a large surplus in equilibrium. Institutions that cause disequilibrium price paths to approach equilibrium systematically from a particular direction or that prolong the period of disequilibrium transactions when the price path is biased will alter the distribution of the surplus that the market generates. Moreover, if random shocks occur frequently enough so that equilibrium is only approached but never reached, institutions that slow the adjustment process also reduce the efficiency of the market. The efficiency loss arises because, if equilibrium is never reached, the exchange institution affects the price of all units, not just inframarginal ones, and therefore affects expectations about prices and hence consumption and production plans.

Price regulation has two features that ought to be analyzed in terms of



their effects on price dynamics. First, a formal regulatory proceeding in which prices can be adjusted in one or both directions only after a formal review leads to disequilibrium transactions that are stuck at the old equilibrium. In periods when nominal costs are falling, "regulatory lag" and entry controls can produce rents even in a competitive environment by prolonging disequilibrium prices. Second, the nondiscrimination requirements of price regulation eliminate any vestige of an auction process from the market. Presumably, the free exchange of disequilibrium offers adds to the richness of information in a disequilibrated market and speeds the adjustment process, although this conjecture is yet to be proved. If so, the requirement to serve all comers at a posted price, even if the regulated price only binds from above, slows downward price adjustments from the old equilibrium.

Whether price dynamics will be proved to be an important element of market performance remains an open question, but in principle the effect of regulation on price dynamics may create a whole new set of economic and political explanations for regulatory interventions. The economics literature has dealt with intertemporal instability, particularly in agriculture, as a cause for a policy intervention that is designed to stabilize prices. Oi (1961), Massell (1969), and Turnovsky (1976), among others, have analyzed the effects on consumers' or total surplus of being guaranteed an average equilibrium price compared with taking random draws each period from a distribution of equilibrium prices. Although these models deal only with comparisons of equilibrium, their premise is precisely that necessary to make price dynamics a potentially important concern. The obvious next step in this literature is to look at additional features of market performance that arise from the effects of intervention on the number and path of disequilibrium transactions.

As suggested above, price dynamics also may prove important in another area of regulatory policy that has assumed greater importance as deregulation of some industries has become more likely: transition from a regulated to a deregulated state. The case here is a little weaker than the argument for considering price dynamics when supply-and-demand relations are uncertain: if firms know demand relations with certainty and all have the same costs in any given market, prices can be expected to follow the short-run marginal cost curve. But if firms are not certain of the position of the demand curve in the range of the new short-run equilibrium, and if firms have different short-run marginal-cost curves and know with certainty only their own costs, a trial-and-error period of disequilibrium price changes can be expected. Although a period of

disequilibrium is unlikely to have consequences so monumental that it alters the case for deregulation, a price path that is substantially at odds with that predicted by economists on the basis of long-run equilibrium analysis could scare politicians, already edgy about the consequences of deregulation, into aborting an experiment with competition. In fact, one such event has already occurred: In Massachusetts, deregulation of automobile insurance was terminated after a few months because the short-run effect was not beneficial to some consumers.

### **Congressional Regulatory Politics**

Like all other public policies, regulation is created and nurtured by Congress. Systematic studies of the influence of Congress on regulatory policies, which remain to be undertaken, may prove important because they may contribute to our understanding of the extent to which the inefficiencies of regulation are endemic to its political environment and because they may uncover important insights about the use of congressional reforms to produce better regulation. In the latter vein, economists are among the most outspoken proponents of "sunset laws" (which force reenactment of regulatory statutes after some fixed amount of time), "sunshine laws" (which require more openness in regulatory proceedings), and mandatory benefit-cost analyses of proposed regulations (such as the Inflationary Impact Statements the Office of Management and Budget and the Council on Wage and Price Stability began requiring for certain regulatory decisions in the mid-1970s). Sunset laws force periodic congressional review of regulatory policy, while sunshine laws and mandatory benefit-cost analysis provide Congress with more information with which to evaluate regulation. In a similar way, the nature of congressional oversight of regulatory agencies might be altered by rearranging the subcommittee structure of Congress, or by instituting direct congressional responsibility for regulatory policy decisions through such means as the proposed one-house veto.

The consequences of these reforms depend upon the likely behavior of members of Congress should the nature and process of congressional oversight be altered. At present the research literature provides little insight into this issue. In general, congressional behavior appears to be purposeful and predictable. Shepsle (1978) showed that the process by which congressmen are assigned to committees is nearly perfect in matching assignments to preferences—even to the point that, when excess demand develops for assignment to a particular committee, the tendency is to expand the committee until a new equilibrium is reached. The implica-

tion is that legislative overseers of regulatory policy are overseers by choice, a choice that presumably reflects their perceptions about what matters to their reelectability. Ferejohn (1974) provided one link between committee membership and reelection strategies by hypothesizing that oversight is used to reward the districts that are represented on the oversight committees, and demonstrated that the distribution of the benefits of one program (river and harbors projects) corresponds to the theory.

How the reelectability of a legislator depends upon his regulatory oversight activities remains unknown. All that is known at present is that oversight committees generally do attempt to influence regulatory policy at a fairly detailed level. Weingast (1977) argued that the mechanism of control is the relative distribution of the budget of an agency among functional categories of expenditures, and related historical changes in regulatory activities within several agencies to these distributional changes. He also found that, while Congress is likely to allocate a total budget that is roughly in line with proposals from the agency and the executive-branch budgeters, its allocations among functional categories (particularly in times of changes in regulatory policy) are likely to be substantially different from those proposed. For example, the mechanisms for making a regulatory agency the captive of the regulated industry appears to be to reduce its analytical resources relative to its legislative responsibilities and enforcement capabilities, thus making it more dependent on outside information for decisions but more capable of enforcing compliance with the decisions it makes.

Several important questions about congressional influence on regulatory policy remain to be addressed. One is the connection between the interests of a legislator (presumably, reelection) and his oversight activities: Exactly what stake does a legislator have in overseeing regulatory policy? Anecdotes about Lyndon Johnson's television station in Austin, Texas, and about the "Staggers Special" (a highly unprofitable commuter train between Washington, D.C. and the home district of Congressman Harley Staggers in West Virginia) should be replaced by systematic, quantitative studies of the deliverable currency of regulatory policy.

Another type of study would assess the importance of certain structural features of regulation and oversight. Some subcommittees oversee a single agency whereas others are responsible for several, and among the latter some of the agencies overseen are branches of executive departments whereas others are independent. Do any of these structural features alter the nature of regulatory policy and the payoffs of legislative overseers?

Systematic, quantitative studies of the role of Congress in shaping

regulatory policy, based on goal-oriented models of the behavior of politicians, are probably more important to those who would reform regulation than to those who would eliminate it. However, would-be deregulators could find them useful as well. The reason is that regulatory reform of any kind must have the assent of Congress— if not explicitly through legislation, then indirectly through an acceptance of change in appointments and policies in agencies. Reformers are more likely to succeed if the changes they propose do not threaten the interests of the legislators who would oversee the reform. At present, the literature on Congress and on the economics and politics of regulation provides only the bare beginnings of an understanding of how, if at all, this can be accomplished.

### **The Behavior of Regulatory Commissions**

To understand the effects of regulation or to pursue regulatory reform requires not only a better understanding of the relationship between legislators and regulators, but also a better understanding of how the regulatory process itself works.

Most regulatory institutions are established under rather imprecise statutes prescribing authorities, organizational structure, and particular policy instruments. A mandate for a regulatory commission to ensure that rates be "just, reasonable, and nondiscriminatory" does not give much guidance, nor does it detail the procedures the commission should follow in arriving at decisions once some kind of operational meaning is given to the statutory mandates. Once a regulatory organization is established, it develops behavioral patterns and a dynamic of its own that are constrained by Congress, but not completely. The political and economic circumstances that led the legislature to establish the regulatory authority may have very different effects on the actual regulatory organization. Perhaps more important is the possibility that the political, economic, and underlying legal environment may change, in part from forces not subject to the control of the regulatory authority and in part from endogenous political and economic consequences of regulation itself which result from the effects of regulation on the behavior and performance of the regulated industry.

In reality, regulatory commissions have objectives, motivations, and responsibilities far more complex than "setting price equal to marginal cost subject to a profit constraint" or "maximizing the present worth of the incomes of commissioners." In addition, many regulatory commissions are complex organizations. There are regulatory commissioners,

who may be appointed or elected and whose terms of office may or may not be coterminous with that of executive, and also a Civil Service staff, including attorneys, accountants, engineers, and other administrative personnel. As in any complex organization or bureaucracy, individuals and groups within the commission have differing conceptions of what they should be doing and what their contribution to the output of the organization is or should be. In addition, regulatory commissions are intimately related to the state and federal judicial systems. Procedures for making decisions on such things as the price of a kilowatt-hour of electricity, the siting of a pipeline, or the location and structural characteristics of a nuclear power plant must be consistent with statutory requirements as interpreted by the courts and must also adhere to complex and changing due-process requirements (Stewart 1975). Regulatory commissions cannot adopt just any procedures they might choose, but are constrained by court-enforced constitutional due-process requirements as well as by the current legislation. To say that the decision of a regulatory commission leads to some inefficiency in a narrow economic sense is not to say very much, unless one considers the constraints of equity, justice, and due process within which decisions must be made. American regulatory procedures and behavior increasingly reflect requirements that the process by which decisions are made be "fair" not only to the regulated firm, but to other concerned parties as well. Stewart (1975) indicated that administrative law has moved steadily away from recognizing the rights of property interests to a more expansive conception of balancing the interests of many different groups affected directly or indirectly by regulatory commission actions.

Complex organizations are often thought to behave according to an internal logic. Organizations do not act independently of the economic environment, but develop stable behavioral patterns to process information and to perform actions, at least in the short run. Organizations such as firms, government agencies, and regulatory commissions develop these decisionmaking rules along with and according to their own concepts of the environment in which they operate. They perceive the environment as having a particular structure, which includes a notion of who the relevant economic actors are, how they behave in response to various stimuli, and how they relate to one another. In addition to the fact that the organizations possess decision rules for processing information, their perception of the structure of the world (or that of its constituent parts) determines what information is observed and processed. For all intents and purposes, the organization's perceptions constitute the

reality in which it operates. The structure of the environment that the organization perceives may be quite different from the objective reality; however, this structure or model of the economic and political environment works from the viewpoint of the organization, in that it consistently explains the behavior with which the organization is concerned.

In the longer run, many students of organizations view organizational structure and behavior as adaptive, responding (often slowly) to changes in the external environment in which the organization operates as short-run decision rules no longer seem to work satisfactorily (March and Simon 1959, pp. 168-170; Cyert and March 1963). Decision rules must often change over time, and so must the structural concept of the environment. If decision rules are not easily modified in the context of the organization's perception of the structure of the world, serious adaptive problems can arise. A new concept of the world may arise, leading to a new set of decision rules that are consistent with it. Alternatively, the organization could become dysfunctional if it does not possess the capability to deal effectively with changed circumstances in the real environment.

As Allison (1972) demonstrated nicely, the "conceptual window" through which we view organizations (in particular, bureaucracies) has critical implications for our ability to predict behavior, especially behavior that is not routine. Work by Niskanen (1971) and Downs (1967) dealing with government bureaucracies argues persuasively that the complex patterns of goals and behavior characteristic of government organizations make it extremely difficult to predict the outcomes of such processes by merely looking at the motivating forces behind their initial establishment. Thus, even if one variant of the "market failure" or "capture" theory correctly captures the *raison d'être* for the establishment of regulatory commissions, these theories may not be particularly useful for understanding the behavior of such agencies over time. In addition, the pluralistic character of much regulation in the United States, which involves overlapping and often ambiguous jurisdictions among different regulatory agencies and between regulatory agencies and the judicial, executive, and legislative branches, seems to require a more expansive concept of regulatory processes that would include more of an emphasis on the regulatory tasks and goals with respect to a particular regulated industry, how they are transformed into regulatory procedures, and how they change over time.

Extensive attempts at modeling the behavior of regulatory agencies and regulatory processes have not as yet been forthcoming. Joskow (1972) examined the behavior of the New York State Public Service

Commission with regard to the process of setting the allowed rates of return in formal regulatory proceedings. He found the commission's behavior to be stable and predictable, but uncovered some adaptive behavior in response to problems engendered by rapid inflation. In a more general study of state public-utility regulation, Joskow (1974) presented a model of a passive state regulatory agency whose behavior adapts to pressures from the economic and political environment in which it operates, and showed how rapid inflation and the recognition of environmental groups as intervenors in administrative proceedings change the behavior of the commission and the results of the regulatory process. This study emphasizes the relationship among commission tasks, the economic performance of the regulated firms, and specific regulatory procedures.

Joskow (1973a) also pointed to another important aspect of regulatory behavior that has often been overlooked in analyses of the effects of government regulation on industry behavior and performance. Much of what is known about what regulators do comes from hearings, court cases, commission opinions (MacAvoy 1971), and the statutes authorizing the regulation. These documents and the process they describe represent the *formal regulatory process*, that is, the documented legal process open for public inspection. It represents the occasional contacts between the regulators and the firms they regulate in formal regulatory or court procedures. Joskow 1973a documents the importance of the *informal regulatory process* (the day-to-day contacts between the agency and the firms). This process may involve discrete prior consultation between the firms and the agency regarding the size or timing of a proposed rate increase or the site for a proposed power plant, and may also include moral suasion regarding such matters as service quality or executive salaries. This paper by Joskow points to the price reductions filed by many New York State electric utilities during the 1960s in the absence of formal regulatory reviews or other overt legal acts by the regulatory commissions as the result of moral suasion and behind-the-scenes bargaining between the staffs of the commissions and the firms concerned. This informal regulatory process represents an attempt to short-circuit many of the time-consuming due-process procedures of American regulatory institutions. Commissions view such ongoing informal activities as being necessary if they are to perform their tasks efficiently. Commission staffs seem to believe that many of the formal legal procedures waste time without altering any of the final outcomes, and that the informal regulatory process is in the public interest. Without making any normative judgment with

respect to the desirability of informal regulatory processes, it must be said that in many cases they are extremely important for understanding both agency behavior and the behavior and performance of regulated firms.

Viewing regulatory commissions as organizations and concentrating on the process of regulatory decisionmaking gives useful insights into what is actually happening. The attempts to model and understand regulation from this perspective often give researchers a more complete static and dynamic structural model of regulation rather than just a reduced form. For those interested in incremental policy reform within the context of prevailing institutions as well as exploring possible institutional alternatives, such structural models are extremely useful for positive policy analysis.

### Experiments

The above discussion of unsolved problems in the economics of information and in disequilibrium price dynamics referred to several studies that used small-group experiments to generate data and test hypotheses in these areas. Experimental methods have also been used to study voting behavior, and have provided tests of theoretical propositions in social choice theory, spatial models of political choice, and game theory.

Experimental methods are rarely used in economics and political science; indeed, among the social sciences, only psychology contains a well-developed subfield of experimental methods. In economics, field experiments have been used rather extensively by government to test such institutional innovations in social policy as the negative income tax, school and health-insurance voucher systems, and peak-load pricing of electricity. The advantage of field experiments is that they provide a mechanism to test a major change in policy without imposing a major financial or political risk on the government and without risking the welfare of an entire target population. The disadvantages of field experiments are that they are very expensive and not completely controllable. Consequently, field experiments are bound to be controversial in both execution and results, even though they can produce better information than can analysis of conventional socioeconomic data.

Except for peak-load-pricing experiments, the government has not taken full advantage of using large-scale field experiments to test changes in regulatory policies. Reform, relaxation, and even repeal of regulatory constraints have become more popular in the past few years, but actual policy change is often held up because of uncertainties about the transition

problem or fears that expectations about the effects of a change in policy might be incorrect. A potentially useful intermediate stage in the process of changing regulatory policy that could overcome these problems is a series of field experiments, designed and evaluated by economists, to test new and less restrictive forms of regulation. For example, the FCC might deregulate cable television in a few markets, offering compensation (should it prove necessary) to local broadcasters if their stations became economically unviable; or a large city might deregulate taxi service in one section of town; or a state regulatory commission might select a few telephone exchanges in which to experiment with a new form of usage-sensitive pricing of telecommunications services. These and numerous other possibilities might serve an important political function in reforming regulation, as well as providing exciting research opportunities for the economists who would be involved in them.

Except in the case of field experiments, economists normally rely on others (government, firms, etc.) to collect and to aggregate their data. This limits the scope of research in numerous ways: Data are often thoroughly contaminated; all of the economic influences that produce the observed results cannot be measured or controlled for purposes of estimating partial effects, and certain types of questions cannot be asked or must be examined indirectly because the most relevant data are not collected.

Laboratory experiments provide an opportunity to control a decision-making environment so that the researcher can generate the kinds of data that are most closely related to the behavioral hypothesis to be tested. V. Smith (1977) detailed the precepts of useful laboratory experiments. One is the notion of induced preferences: The experimenter can finesse much of the problem of differences in tastes among subjects by building strong monetary incentives into the experiment. Another is the idea of parallelism: An experiment should contain all of the potentially important structural features of a real-world decisionmaking institution.

Faithful adherence to these and other precepts of good experimental design are difficult to follow, and a potential entrant into this domain of research can expect to experience considerable frustration in discovering the pitfalls of laboratory experimentation. Nevertheless, the potential payoffs are considerable. First, laboratory experiments permit generation of data that are not observable if one is restricted to the records of real-world market transactions. Bargains and rejected offers can be observed, and the experimenter can determine the amount of information, the risk distribution, and the possible gains from trade facing each participant.

The richer scope of available data and the controllability of factors that are normally unmeasurable in real transactions expands the range of testable hypotheses. Second, laboratory experiments allow the researcher to test the comparative efficiency of institutional arrangements, including arrangements that do not exist in the real world, with other influences held constant. This can have great practical importance to decisionmakers because it allows them to gather information about a proposed institutional change, much as field experiments do, but with greater controllability and lower cost.

Several examples of the second use of experiments have emerged. V. Smith (1977) reported a series of auction experiments that pretested a mechanism that was later adopted by a major corporation and by the French government for marketing bonds. Ferejohn et al. (1979) used experimental procedures to pretest for the Public Broadcasting Service some proposed changes in the mechanism used to acquire television programs. Hong and Plott (1977) used experiments to provide the Department of Transportation with an evaluation of proposed changes in the rules of the Interstate Commerce Commission with regard to the advance posting of price changes in the barge industry.

Experimental methods could provide important new information in several areas. They could be used to generate information and to test hypotheses concerning individual behavior with incomplete information (experiments have already begun to bear fruit in this area). Another is in testing regulatory interventions that are designed to change the amount and type of information that is available to participants in a market. Another is to extend V. Smith's pioneering efforts to compare the performance of different forms of market institutions according to the type and form of communication that is allowed among buyers and sellers. Still another is to test alternative mechanisms for dealing with external effects, an issue that Plott (1977) explored in a preliminary fashion. The list goes on; we recommend V. Smith's intriguing 1977 survey as a more complete and very interesting defense of the forecast of an important role for experimental methods in applied economics.

### Extensions of Traditional Lines of Research

Having presented some perspectives on possible lines of future research that counsel economists to work on the frontiers of microeconomic theory, economic models of political behavior, organization theory, experimental methods, and even some parts of psychology, we hasten to add that more traditional lines of research can still bear fruit. Certainly,

there remain many opportunities for interesting research in the vein of studies discussed in the first section above. We will expand on some of these opportunities here.

Numerous regulated industries (particularly those regulated by state and local governments) have not been studied empirically at all. One potentially important area for regulatory research is the medical-care sector, which consumes nearly 10 percent of the GNP. Since 1970, nearly all of the states have begun to regulate some aspect of the delivery of health care services (usually, prices and or entry in the hospital industry). Because hospitals have local markets, and because the timing and form of regulation differ among the states, opportunities abound for examining the effects of various types of regulatory rules and the overall effect of regulation. Moreover, because the move toward regulation is recent, scholars have better and more reliable sources of information on the political economy of regulation: the motives and behavior of political actors in setting up these institutions. A thorough, comparative study of hospital regulation in the United States would be a major contribution to the literature.

We anticipate substantial new studies that will evaluate the effects of safety regulation more thoroughly than anything that can be found now in the literature. The form this research will take is extensive studies of the regulation of a particular hazard, like Peltzman's (1976) study of automobile safety. Most of the data for these analyses are available from governmental agencies; the NEISS data from the Consumer Product Safety Commission are one example. Added comprehensiveness will be achieved by attempts to account for the effects of regulation in more sophisticated, multiple-equation models of demand and costs in the regulated industry. We doubt, however, that econometric techniques will be refined enough to succeed in generating uncontroversial conclusions about the magnitudes of the effects of these regulations.

Substantial research opportunities using traditional theoretical and empirical techniques remain in agriculture and in such areas of the financial sector as banking, insurance, and securities. These sectors have largely been ignored by regulatory economists, and are ripe for additional research. Contrary to the elementary textbook concept, agriculture is subject to a wide variety of price, production, and entry regulations for specific commodities. In addition, the administration of these regulations appears to be considerably different from that which characterizes traditional regulatory commissions. In financial markets, differences in regulation across states make comparative analysis possible. Recent changes in

banking regulation (such as the allowance of interest payments on demand deposits) are worthy of further study, as are the effects of open competition in the property- and liability-insurance markets and the elimination of fixed minimum commissions in the securities industry. Similarly, as more states relax restrictions on advertising by professional groups and ease entry requirements, additional information should be available to assess the effects of professional licensure and other restrictions on competition in service industries.

Most of the empirical literature on regulation focuses entirely on U.S. industries. Little effort has been made to exploit available data on the costs, prices, quality, and rate of technological change in the same industries in other developed countries. In much the same way as comparisons between publicly and privately owned electric utilities in the U.S. have sought to expand our understanding of the effects of government regulation, comparisons across countries may provide an opportunity to evaluate a more diverse menu of institutional alternatives.

Finally, the tendency of existing empirical work to focus on questions of aggregate economic efficiency has caused the distributional consequences of regulatory policy to be largely ignored. This is quite surprising in light of the fact that all theories of regulation indicate that the distribution of the costs and benefits of regulation are important. As a result, economists have had relatively little to say about a set of issues that are of considerable concern to legislators, regulators, and the public. In much the same way as economists who study taxation have examined the distributional consequences of various tax schemes, regulatory economists could obtain similar types of research results from existing data. Such analyses do not require that scholars identify the "right" income distribution, but will allow us to provide information that will be useful in understanding regulation itself and in explicating the consequences of regulatory reforms. Virtually every industry that has been the subject of regulatory research is a candidate for further work directed at identifying the distributional consequences of existing regulatory policies and regulatory reform proposals.

## Conclusion

The past twenty years has been a watershed for the study of government regulation by economists. Modern theoretical and empirical techniques have been brought to bear on the effects of government regulation in a wide range of industries. Although useful incremental additions to

knowledge in the traditional areas of government regulation are likely to be forthcoming through traditional analytical techniques, it is our belief that the greatest opportunities lie in areas in which the traditional modes of theoretical and empirical analysis are not likely to be as productive as they have been in the past. The future direction for research that we envision involves the utilization of new theoretical and empirical techniques and a change in emphasis. With regard to techniques, we see information economics, disequilibrium price dynamics, models of political and organizational processes, and the use of large- and small-scale experiments as playing important roles in regulatory research. With regard to emphasis, we see further analyses of the incidence of government regulation (rather than its global-efficiency properties) and an effort to understand how regulation can be made to perform a wide variety of tasks better (rather than whether these tasks are legitimate or not) as targets of opportunity. Furthermore, we see these new directions not as independent of, or replacements for, the important research that has already been done, but as serving to build upon and expand what is already known. However, we do believe that economists know a lot less about government regulation than is sometimes thought, and that a large amount of important research remains to be done.

Professor Joskow acknowledges support from a grant by the Sloan Foundation to the Department of Economics at MIT. Professor Noll gratefully acknowledges support from National Science Foundation grant APR75-16566.

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